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The Automobile and Automotive Industries

Vol. XXXVII — New York—Thursday, August 23, 1917—Chicago — No. 8

Ford Tractor Worm Driven

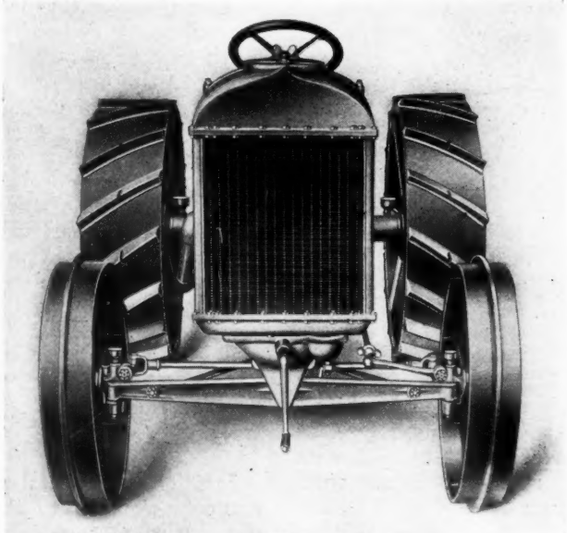
First Technical Description of the New Ford Tractor To Be Built at Dearborn, Mich.—A Unit Power Plant Combined With the Final Drive Housing Replaces the Frame—Other Features of Design

By J. Edward Schipper

The Automobile and Automotive Industries is under obligation to Henry Ford & Son and to their tractor engineer, C. E. Sorensen, for giving its representative a chance to obtain at first hand the data necessary for writing this description of the new Ford product.

After 3 years of experimental work in the engineering laboratory and on the farm, the tractor of Henry Ford & Son, which is the culmination of plans first conceived in 1907, has attained a stage where its manufacture is about to be begun. In a few weeks the big production schedule will be started, and the tractors will then be put through in great numbers. As has been reported previously in The Automobile and Automotive Industries, the first part of the output probably will be absorbed by Great Britain, but the factory in Dearborn, Mich., is planned on such a scale that both the foreign and domestic demands may be taken care of before long.

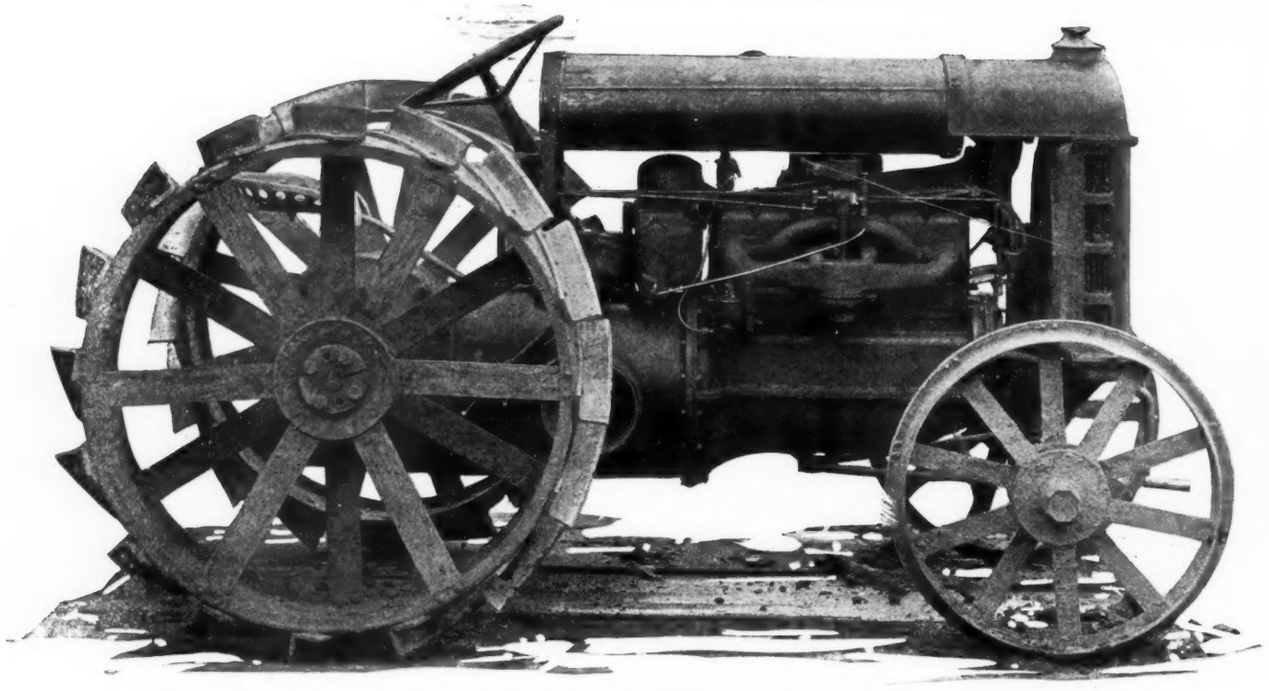
From an engineering standpoint the Ford tractor possesses characteristics which distinguish it from all others. The first striking feature is that it has no frame. An examination of the tractor shows that in a great many instances parts which ordinarily perform but one function have been made to do the work of two or three parts. For instance, the crankcase, gearbox and rear axle housings serve not only their regular purpose, but also form the frame of the machine. In thus combining dual or multiple functions in various parts, two objects have been aimed at, namely, reduction of weight and simplicity of construction. As a further means to weight reduction high grade materials are used, and these materials have been disposed with a keen eye to accessibility of wearing parts and facility of manufacture. In other words, the Ford tractor is designed throughout as an easy-to-manufacture machine, as well as one which will do the greatest amount of work for a tractor of its size or weight. The weight is 2500 lb.



Front of Ford tractor, showing rocking front axle and steering connections

Taking the machine as a whole, it is best described as a unit construction. The engine, transmission and rear axle housings are bolted together so as to form one solid piece, which acts as the backbone of the machine. This unit is mounted flexibly on the front axle so that no undue stresses are imposed on the running gear by irregularity of the ground.

A close study has been made of the best materials for each part of the machine. These materials are all the best obtainable for the particular work, and a large amount of alloy steel is used. Special heat treatments have been worked out



Right side of the Ford tractor, with the side panel removed, exposing engine and power plant attachments

to give the best physical characteristics for definite purposes.

The engine is a four-cylinder 4 by 5 in. L-head block type, having a displacement of 251.3 cu. in. According to tests which have been made on the dynamometer at the plant of Henry Ford & Son, it is capable of delivering 22 hp. at 1000 r.p.m. This is with kerosene and at a compression of 60 lb. absolute. The working torque of the engine is 1500 in.-lb.

Semi-Steel Cylinders

The engine block is cast from semi-steel; in other words, from iron refined by the addition of about 15 per cent of steel scrap. The crankcase is also of semi-steel, as are the pistons, which latter are 4⅞ in. long The pressure on the piston head is transmitted through the pin bearings, which are in the bosses of the piston, to a 1⅜-in. piston pin of chrome vanadium steel. The bearing length on this pin is 2¼ in., the pins bearing directly on the cast iron of the pistons.

Three crankshaft bearings are used, and are provided with interchangeable caps. This is one of the features of the machine tending toward simplicity and making for low manufacturing cost. It also is a factor in the maintenance of the tractor. All of the crankshaft bearings are 2 in. in diameter and 3¼ in. long.

A steel pinion is carried on the end of the crankshaft and meshes with a cast-iron gear on the camshaft. These gears have helical teeth. The camshaft is carried in three bearings, each 1 15/16 in. in diameter, the lengths of front, center and rear bearings being 2¾, 2½ and 1½ in. respectively. The cams are forged integral with the camshaft and operate directly on mushroom tappets. No adjustment is provided between push rod and the valve stem, the poppet valves being operated directly. These valves have a clear diameter of 1½ in. and a lift of 5/16 in. The valve timing is as follows: Intake opens 10 deg. after top center and closes 40 deg. after bottom center; exhaust opens 45 deg. ahead of bottom center and closes on top center.

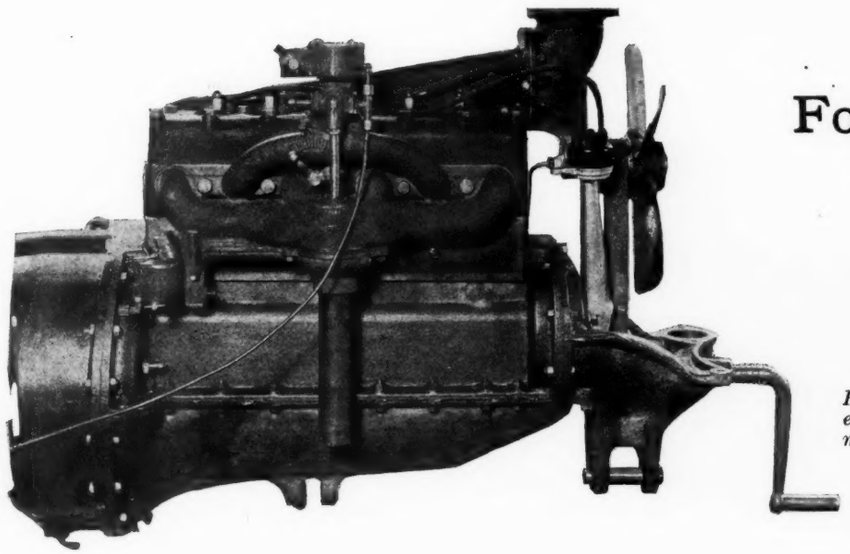
Fuel is carried in an overhead kerosene tank having a capacity of 21½ gal., which is carried by supports above the engine. For starting gasoline is used and a gasoline tank holding about 1 qt. is provided. The vaporizing system consists of a single bowl carbureter in connection with the vaporizing manifold, in which the intake passes through a coil surrounded by the exhaust gases. All the air passes through an air washing device filled with water. First the kerosene is sprayed into the primary air, and after this mixture has been completely vaporized in the coil, the secondary air is added at a point above the coil. A distinctive feature is the use of a damper on the manifold for controlling the amount of heat reaching the coil.

One of the problems that have been given the most thorough study in the design of this tractor is that of cooling. In line with the policy of producing a tractor of the utmost simplicity neither a water pump nor an oil pump has been provided. The thermo-syphon system of cooling water circulation is used, the quantity of water carried being 11 gal. There are certain distinctive features in this thermo-syphon system which deserve mention. In the first place, the waterjackets extend the entire length of the cylinder, down to the crankcase flange. No rubber hose connection is used between the radiator and engine, the two being bolted together. Other points are the elimination of all restricted passages and the care with which the water passages to the detachable head have been designed so as to prevent the formation of steam pockets. The water outlet in the radiator has an area approximately equal to that of a 3-in. pipe. The radiator is of the flanged tube type, having an 18 by 20 in. core with a depth of 4 in. Cooling is aided by a four-blade, 17-in. fan operated by a 2-in. flat belt on cast-iron pulleys at the end of crankshaft and on the fanshaft. The fan runs on ball bearings.

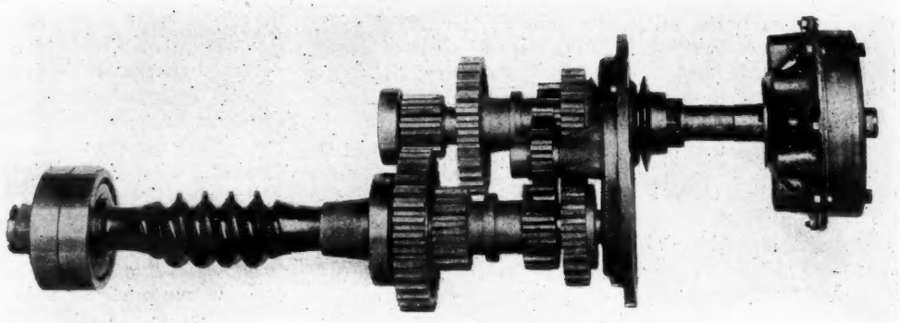
Ford Flywheel Magneto

Ignition is by a flywheel magneto. There are ten magnets clamped to the flywheel which rotate behind the stationary armature. The voltage of the magneto varies with the speed of the engine from 6 to 14 volts, a hotter spark being produced at higher speeds. The

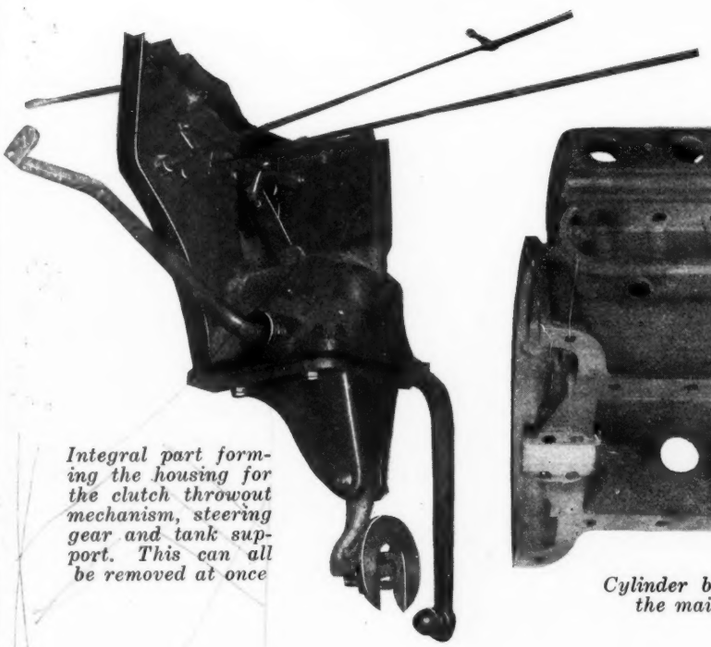
Ford Tractor Details



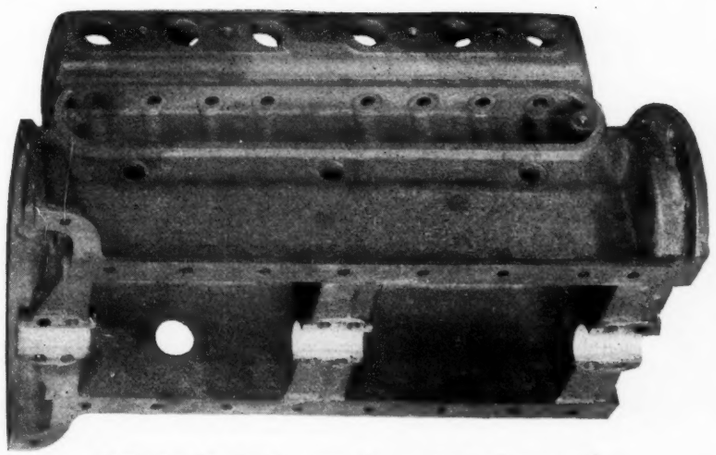
Right side of the Ford tractor engine, showing vaporizing manifold with damper control for heat



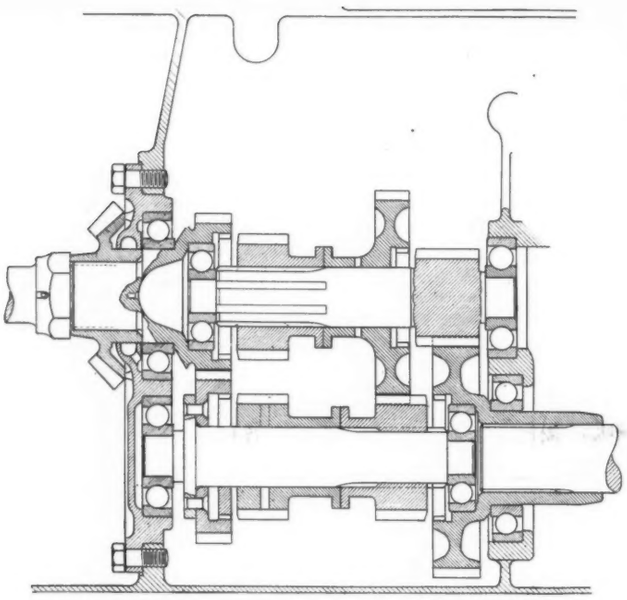
Transmission units, including clutch, gearset and worm, used on the Ford tractor



Integral part forming the housing for the clutch throwout mechanism, steering gear and tank support. This can all be removed at once



Cylinder block, showing the method of supporting the main bearings on the Ford tractor engine



Sectional diagram of three speed and reverse Ford tractor gearset. The engine is coupled to the upper shaft and the worm to the lower

voltage is close to 14 at 1000 r.p.m. The current generated is delivered to a single induction coil. The breaker mechanism is incorporated with the distributor, the combined instrument is mounted on a vertical distributor shaft driven through miter gears from the camshaft.

Oiling is by constant level splash, the flywheel magnets being used as a propeller or circulator. The oil caught up by these magnets is thrown into a scoop at the end of an oil pipe which leads to the front of the crankcase. Here the oil overflows to troughs beneath each of the four connecting rods. The beating of the connection-rod spoons into these troughs of oil throws up a spray which lubricates the entire interior of the engine, including the main bearings and timing gear. No attention need be given the oiling system, except to see that it is supplied with lubricant. The capacity of the system is 2½ gal.

From the engine, the drive is transmitted through a multiple disc clutch running in oil. There are seventeen tempered steel discs in this clutch, which have an effective face width of 1 1/16 in. The outside diameter of the discs is 7 in. and they are held in engagement by six 80-lb. springs, giving a total pressure of 480 lb.

The clutchshaft or driveshaft is supported by a pilot bearing at the rear end of the crankshaft and carries the constant mesh gear for the three-speed gearbox. This is on the upper shaft of the gearbox, and the lower shaft is direct-connected to the worm which provides the final drive. By means of the combination of the reductions in the gearbox and in the worm gear, which latter has a ratio of 17.5:1, the following total reductions are obtained:

Gear	Ratio	Miles per hour at 1000 r.p.m. of crankshaft
High	18.25-1	6.83
Low	85-1	1.34
Reverse	48-1	2.60
Plowing (intermediate)	46-1	2.70

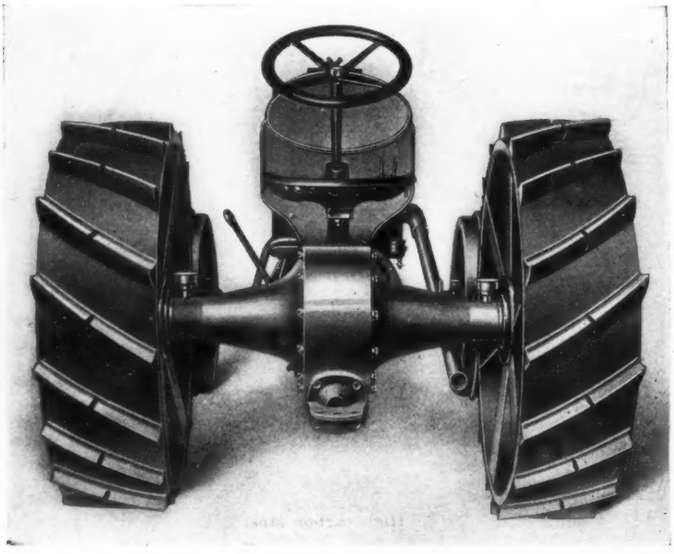
All the gears and shafts of the transmission set are of chrome vanadium steel and the shafts are carried on ball bearings of a type capable of taking both radial and thrust loads of considerable magnitude.

The worm gear is of undermounted type. It comprises a 60-deg., double-thread straight worm having a pitch of 1.2 in. At the rear end the worm shaft is supported in a duplex radial and thrust bearing. The worm is made of chrome vanadium steel and the worm wheel of aluminum bronze, which is composed of 10 per cent aluminum and 90 per cent copper.

The worm wheel is secured to the differential housing by twelve bolts. The differential, which is a four-pinion type, transmits the drive to the semi-floating axle. The driving wheels are mounted on the shaft by means of a slotted, tapered hub filling provided with a flange drilled for four heavy cap screws. The hub piece is splined at the axle connection, to render the transmission of the driving torque more secure.

Steering is through a bevel gear sector and pinion, with a ball-end drop arm connecting through a large rod to the front axle cross arm. The steering reduction between the pinion and sector is 3½ to 1 and an 18 in. hand wheel is mounted on the 1-in. column.

The driving wheels are 42 in. in diameter and are provided with suitable traction lugs on the rims. The best shape of the lugs is one of the details which is engaging the attention of the engineers at present, a self-cleaning lug being the object aimed at. The wheel rim is made of hot rolled steel. The front wheels are also of hot rolled steel and are of built-up T section, the spokes being riveted between two angle irons placed back to



Above—Worm gear and belt pulley of the Ford tractor
Right—Rear view of a complete Ford tractor ready for service. The absence of the conventional frame gives it a peculiar appearance

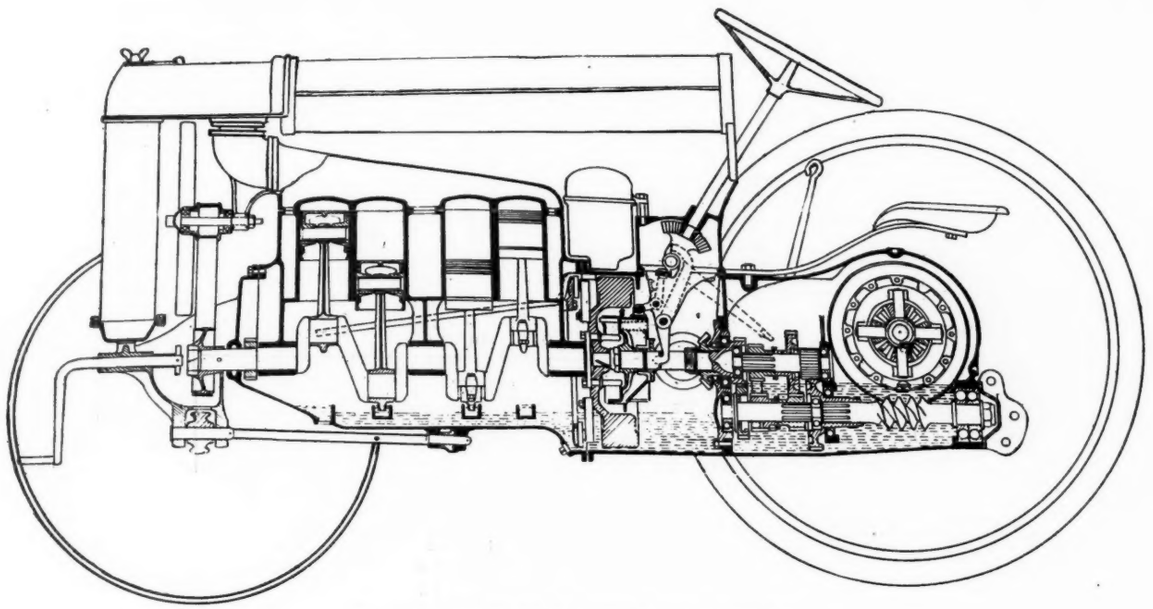


Diagram showing Ford tractor lubrication system

back, with a flange projecting outward to serve as a skid ring. The diameter of the wheel proper is 28 in., but the total diameter over the skid ring is 30 in. The front axle is an I-section forging, this design having replaced the three-piece built-up construction formerly employed. The wheels are carried on combined radial and thrust ball bearings.

The hard ground road clearance of the tractor is 11 in., the lowest point of the tractor being the flywheel housing. On medium ground, where the vertical flange of the front wheel will sink into the surface, the clearance is 10 in.

One of the points which have been borne in mind in laying out this tractor is the fact that the farmer—usually a man of little mechanical experience—will have to take care of it. Everything can be reached with comparatively little effort. For instance, the crankcase can be dropped while the tractor is standing on its wheels, the only part needing to be removed being the radius rod. The tractor is able to turn in a radius of 21 ft. and can work steadily under a 1500-lb. drawbar pull or a two-plow load, on the plowing (intermediate) gear, which still leaves a 25 per cent reserve of power.

Chief Parts of the Ford Tractor, Showing the Materials from Which They Are Made

Part	Material
Cylinder	Semi-steel
Crankcase	Semi-steel
Pistons	Semi-steel
Piston pin	Chrome vanadium steel
Connecting-rods	Chrome vanadium steel
Crankshaft	Chrome vanadium steel
Main bearings	Babbitt cast in steel caps
Valve heads	Cast iron
Valve stems	Carbon steel
Camshaft	0.15 carbon steel
Valve tappets	0.15 carbon steel
Clutch plates	0.40 carbon steel
Clutch shaft	Chrome vanadium steel
Transmission gears	Chrome vanadium steel
Transmission shafts	Chrome vanadium steel
Axle shafts	Chrome vanadium steel
Worm	Chrome vanadium steel
Worm wheel	Aluminum bronze (10% aluminum, 90% copper)
All ball bearings	Chrome steel
Bearing races	Chrome steel
Front axle	High carbon steel
Front wheel spindles	Vanadium steel
Wheels	Hot rolled steel

Training of Aeronautical Engineers

A COLLEGE course for aeronautical engineers was outlined by Dr. R. Mullineux Walmsley in a recent lecture before the Aeronautical Society of Great Britain. The 4-year course is divided into a 2-year period of general training and a 2-year period of specialized training in aeronautics. The special aeronautic training begins in the third year. A good knowledge of mechanics provided during the first 2 years leads up to instruction in the theory of machines and of mechanism, and in the advanced work such problems as the balancing of engines of various types and the general design of heat engines are taken up. More advanced work than can well be included in the preliminary courses is given on the strength, elasticity and fatigue of materials and proceeds concurrently with other subjects relating to airplane engineering. The effects of fatigue on the various parts of an airplane structure, due to reversal and repetition of stresses, are believed to have been the causes of some disastrous failures of airplanes.

The bulk of the practical shop work provided for in the last 2 years is to be taken at airplane factories and not in college shops, during the summer vacation periods, and this work may be continued if necessary at the end of the fourth year. During the last 2 years visits are to be made to flying grounds and perhaps flights made by the students as passengers.

Dr. Walmsley is connected with the Northampton Institute, where the course outlined is to be given.

Rubay Body Designs

A TASTILY gotten up booklet has come to hand from the Rubay Co., Cleveland, Ohio, illustrating a considerable number of designs of automobile bodies which the company is prepared to furnish. The firm designs and builds special types of bodies according to customers' specifications and offers to aid the customer in drawing up the specifications, placing at his disposal its experience in and intimate knowledge of custom body building.

Laying Out Steering Gears

A Simplified Method for Determining the Angular Errors of One Wheel for Various Angles of the Other Wheel and Various Proportions of the Steering Linkage

By H. A. Stevens Howarth

IT is generally known among engineers that when a vehicle travels in a curved path on a plane surface, as when turning a corner, the axes of all the wheels, when viewed in plan, should appear to intersect at one point, the center of curvature of the path. If this condition is realized in the design of the steering mechanism, the design is considered correct in this respect. If it is not realized, each wheel will endeavor to swing the vehicle about a center that lies on the produced axis of that particular wheel. The result will be that the vehicle will travel in a path which results from the sum of the steering powers of the several wheels. The tires of the wheels will creep or slip sidewise sufficiently to accommodate themselves to the actual path of the vehicle. As this side slip or creep causes the tires to wear, it is advisable to design the steering mechanism so as to reduce the errors to a minimum. It is not possible entirely to eliminate them with the type of mechanism commonly used for motor vehicles.

Most motor vehicles have the two rear wheels mounted on a common axis. Hence the axes of the front wheels, when viewed in plan, should intersect on the rear axis produced. The position of this point of intersection should lie closer to the vehicle when making a short turn than when making a long turn.

As a matter of fact, the steering mechanisms commonly used are only approximate in their action. The intersections of the front wheel axes, as the curvature of the vehicle's path is varied, will lie on a curve, only a portion of which lies approximately along the common axis of the rear wheels.

The following presents a means of quickly determining the properties of one of the types of steering mechanisms (see Fig. 1) commonly used on motor vehicles. Old designs can be readily investigated, or new designs evolved with equal ease. No cutting and trying are needed. The curves 12-22 inclusive, Fig. 3, furnish the solutions of the problems. They show the loci of the intersections of the produced steering wheel axes for a wide range of design proportions. They also show the angular errors involved in the various designs. By noting how a given locus lies with respect to the produced rear axle center line the value of the proportions which give that locus is quite evident.

The methods employed in making the calculations and in plotting the curves will be given first. Then the way to use the curves will be explained.

In Fig. 1 will be found a skeleton plan of the front and rear axles and the steering mechanism. The latter and the front wheels are shown in two positions—straight ahead and swung to the left. The right front wheel is shown in three positions, the position R_3 being the corrected position of R_2.

If wheel L_1 is swung counter clockwise through angle β to position L_2, the steering arms and tie rod will swing wheel R_1 to position R_2. The steering knuckle axes will then intersect at some point P. If there is to be no side creeping of the tires the intersection of those axles should be at Q on the rear axle center line. The angular error in the position of the wheel R_2 is $POQ = \varepsilon$, i.e., the wheel should be at R_3.

When the front wheels are in mid-position, pointing straight ahead and parallel, the steering knuckle arms AB and OC should not be parallel. Each should make an axle α with the wheel, or with the lines AF and OG which are perpendicular to the front axle.

When wheel L_1 is swung through angle β to position L_2 the arm AB is shifted to AD; the tie rod BC is moved to

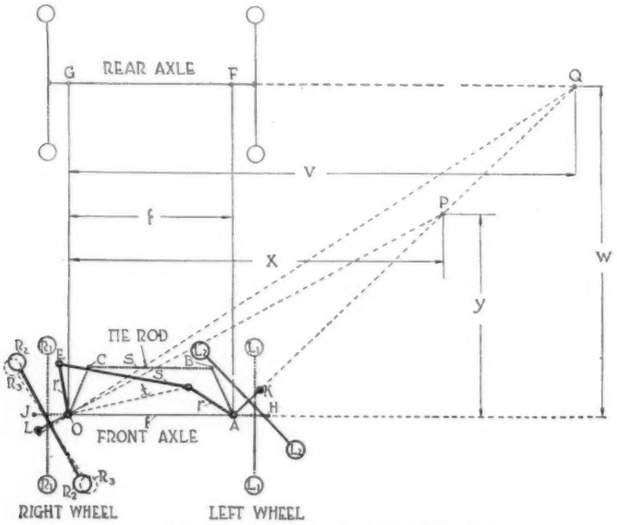


Fig. 1—Diagram of steering layout

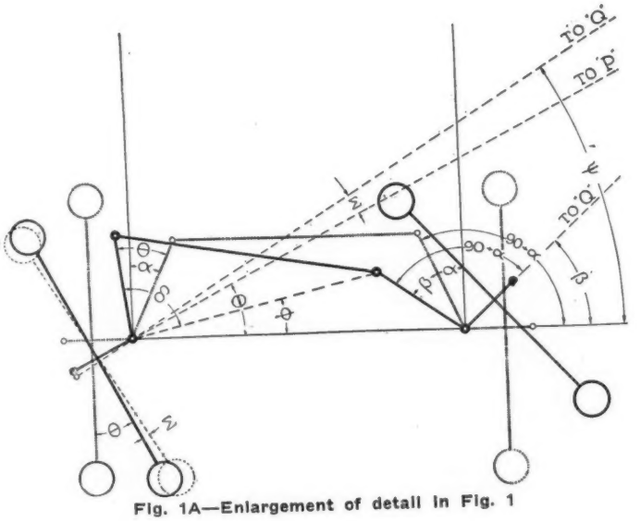


Fig. 1A—Enlargement of detail in Fig. 1

DE; arm *OC* is swung through angle θ to *OE;* and wheel R_1 is swung through angle θ to R_2.

For this new configuration the center line of the steering knuckle axis *AK* will intersect the rear axis at *Q*, whereas the opposite knuckle axis *OL* will intersect the first at *P*, whose co-ordinates from *OG* and *OA*, produced, are x and y. For every proposition of the steering mechanism the points *Q* and *P* will coincide for but one angular position β' of the front wheel L_2'. This is evident if we lay out the locus of p for a wide range of values of β and note its character. For example see curve marked ($\alpha = 15°$) in set of curves (12).

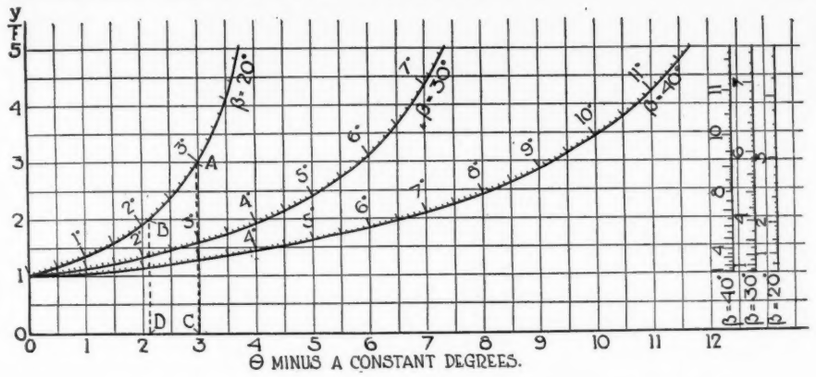


Fig. 2—Useful portions of curves connecting y/f with θ—constant

Making Calculations for Curves

The values of the co-ordinates of *P* are found as follows, using these additional notations:

$r = AB = OC =$ length of steering knuckle arms.

$f = OA =$ length of front axle from center to center of steering knuckle pins *O* and *A*.

$w = AF = OG =$ wheelbase.

$s = BC = DE =$ length of tie rod.

$m = \dfrac{s}{f} =$ ratio of tie rod length to front axle length.

$n = \dfrac{r}{f} =$ ratio of steering arm length to front axle length.

Let $t = OD$ divide figure *ADEOA* into two triangles.

For mid-position, $S = BC$, we have

$$S = f - 2r \sin \alpha \qquad (1)$$

$$\sin \alpha = \frac{f - s}{2r} = \frac{1 - m}{2n} \qquad m = 1 - 2n \sin \alpha \qquad (2)$$

For position β we have $S = DE$, and

$$t^2 = r^2 + f^2 - 2rf \cos (90 - \alpha - \beta) \qquad (3)$$

$$t^2 = f^2[n^2 + 1 - 2n \cos (90 - \alpha - \beta)]$$

If we let $K^2 = [n^2 + 1 - 2n \cos (90 - \alpha - \beta)] \qquad (4)$

we have $k = \sqrt{n^2 + 1 - 2n \cos (90 - \alpha - \beta)}$ and $t^2 = k^2 f^2$.

$$S^2 = r^2 + t^2 - 2rt \cos \delta \qquad (5)$$

$$\text{Cos } \delta = \frac{n^2 + k^2 - m^2}{2kn} \qquad (6)$$

$$r^2 = t^2 + f^2 - 2tf \cos \phi \qquad (7)$$

$$\text{Cos } \phi = \frac{1 + k^2 - n^2}{2k} \qquad (8)$$

$$\theta = \alpha + \phi + \delta - 90° \qquad (9)$$

Equation of line *OP* is $y = x \tan \theta$.

Equation of line *AP* is $y = (x - f) \tan \beta$.

Hence

$$\frac{x}{f} = \frac{1}{1 - \dfrac{\tan \theta}{\tan \beta}} \qquad (10)$$

$$\frac{y}{f} = \frac{x}{f} \tan \theta \qquad (11)$$

Let us assume the following proportions:

$$\alpha = 15° \qquad n = \frac{r}{f} = 0.10$$

Find the co-ordinates of *P* when $\beta = 20°$:

$m = 0.9482$ from equation (2)

$m^2 = 0.8992$

$k^2 = 0.8953$ from equation (4)

$k = 0.9462$

$\delta = 88° 8.8'$ from equation (6)

$\phi = 4° 59'$ from equation (8)

$\theta = 18° 7.8'$ from equation (9)

$$\left.\begin{aligned} \frac{x}{f} &= 9.96 \\ \frac{y}{f} &= 3.26 \end{aligned}\right\} \text{co-ordinates of } P.$$

This point *P* is one of the points on curve marked ($\alpha = 15°$) on set of curves (12). The distance 0 to 1. on the lower scale represents the length of the front axle and its position with relation to the curve. Since the vertical scale shows values of $\frac{y}{f}$ it also represents $\frac{w}{f}$. Hence the horizontal line through 2. on the vertical scale represents the rear axle of an automobile whose wheelbase is twice the length of the front axle.

Enough points were calculated to determine the char-

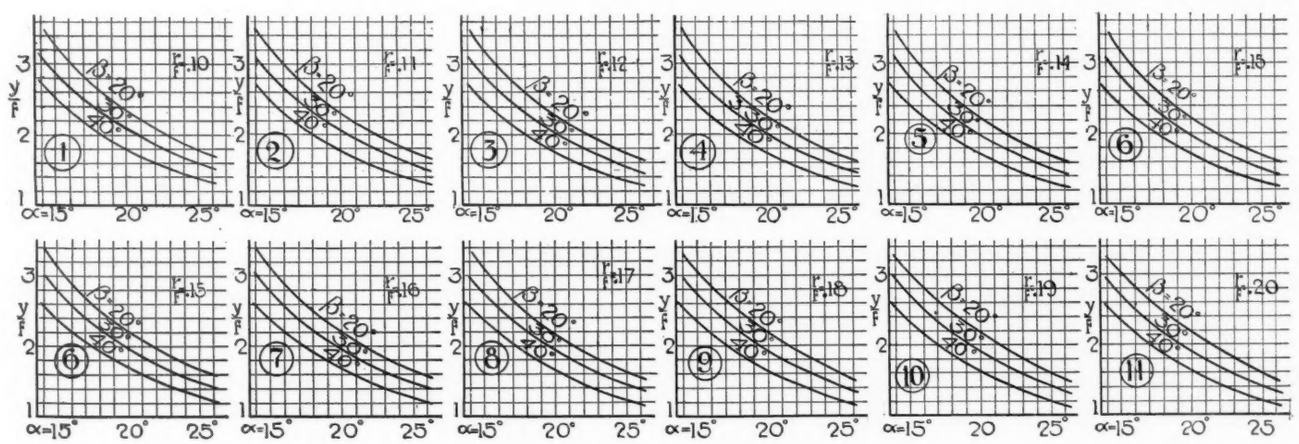


Fig. 3—Angular scale for use with curves 12-22

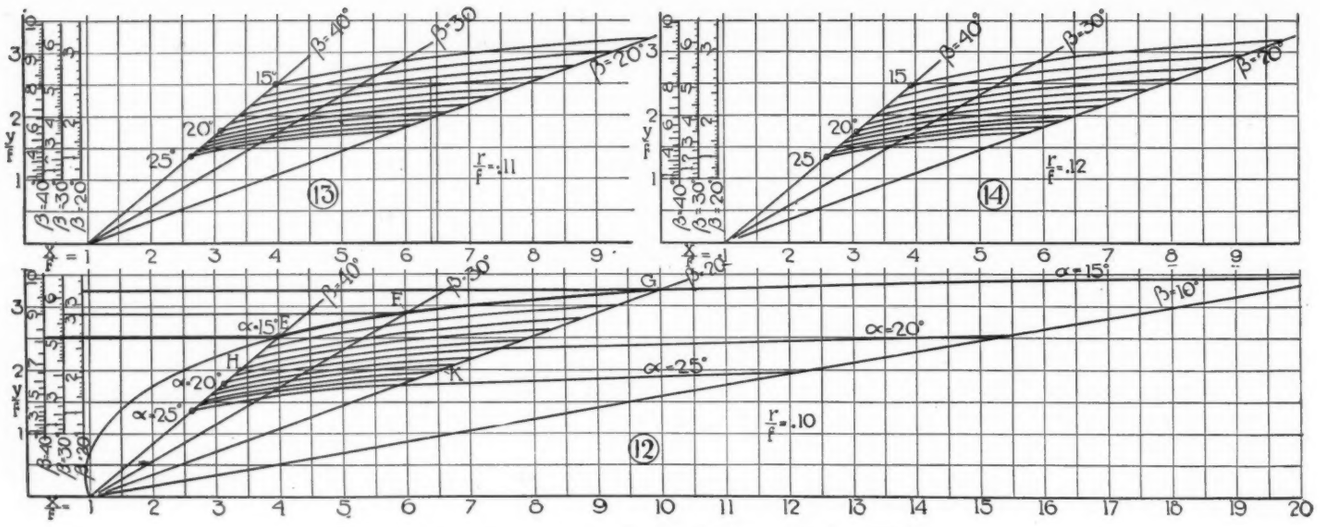


Fig. 4—Curves of angular errors for different steering conditions

acter of this curve for a wider range of angles β than could possibly be used in steering. It then seemed to the writer that the useful range of this curve and of the curves for other proportions would be that determined for the values of the angle β lying between 20° and 40°. Hence calculations were made from which curves (1), (6) and (11) were plotted. From these the intermediate curves (2) to (5) and (7) to (10) were obtained. By the assistance of curves (1) to (11) the more useful series of curves (12) to (22) were drawn for $\alpha = 15°$, $\alpha = 16°$, etc., to $\alpha = 25°$. Each of the curves in a set from (12) to (22) will be referred to by the angle α for which the particular curve was plotted.

Calculating Angular Errors

Considering curve ($\alpha = 15°$) of set (12), one may ask for what length of wheelbase are those proportions $\left.\begin{matrix}\alpha = 15° \\ \frac{r}{f} = 0.10\end{matrix}\right\}$ best suited, or are they suitable for a car of a given wheelbase? These queries suggest the necessity for a simple means of studying the angular error ε. This means is found as follows:

From Fig. 1 we find that $\varepsilon = \psi - \theta$.

$$\text{Tan } \theta = \frac{1}{\cot \beta + \frac{f}{y}}$$

$$\text{Tan } \psi = \frac{1}{\cot \beta + \frac{f}{w}}$$

The forms of the equations for tan θ and tan ψ are identical. This is true because ψ is the particular value of θ for which $y = w$.

Let us calculate the points on curves showing the relations between $\frac{y}{f}$ and θ for β = 20°, 30° and 40°, and for $\frac{y}{f}$ from 1. to 4. These calculations are tabulated as follows:

$\frac{y}{f}$	β = 20°		β = 30°		β = 40°	
	θ	θ − 15°	θ	θ − 20°	θ	θ − 24°
1.00	14.94	−0.06	20.10	0.10	24.52	0.52
1.25	15.74	0.74	21.55	1.55	26.66	2.66
1.67	16.63	1.63	23.21	3.21	29.17	5.17
2.00	17.11	2.11	24.13	4.13	30.59	6.59
2.50	17.62	2.62	25.13	5.13	32.14	8.14
3.33	18.17	3.17	26.20	6.20	33.84	9.84
4.00	18.45	3.45	26.77	6.77	34.74	10.74
5.00	18.74	3.74	27.37	7.37	35.70	11.70

Since we want a means of studying the angular differences between θ and ψ we will plot in Fig. 2 the useful portions of the curves between $\frac{y}{f} = 1$ and $\frac{y}{f} = 4$, subtracting a different constant angle from each set of values of θ so the three curves will lie in the same field. These curves are useful as follows:

Assume β = 20°. Let $\frac{y}{f} = 3$ represent $\frac{w}{f}$. It cuts curve (β = 20°) at *A*. Let $\frac{y}{f} = 2$ represent the ordinate of the intersection of the steering knuckle axes. It cuts curve (β = 20°) at *B*. Drop verticals through *A* and *B* to the horizontal scale, which they cut at *C* and *D*. The intercept *CD* measured by the horizontal scale is the angular error ε when the steering wheel is in position β = 20°. This error ε = 2.97 − 2.11 = 0.86°.

It is at once evident that the verticals are needless if we project the horizontal angular scale on to the curves. It is further evident that the curves may be made vertical lines if the vertical components of their angular scales are not altered. This brings us to the vertical scales β = 20°, β = 30°, β = 40°, shown in Fig. 3. These angular scales may be applied to any one of the sets of curves (12) to (22) unchanged, because they are not affected by the varying proportions $\frac{r}{f}$ and α. Hence we have laid them off for convenience for each set of curves (12) to (22).

Method of Using Curves

Let us now study a problem thoroughly by means of the curves.

A given car has a wheelbase twice the length of its front axle, i.e., $\frac{w}{f} = 2$. Each steering knuckle arm is inclined at an angle of 15°, i.e., α = 15°. The length of the arm is one-tenth the length of the front axle, i.e., $\frac{r}{f} = 0.10$. Can these proportions be improved?

The answer is found in set of curves (12). Since α = 15°, we study curve marked α = 15°. Line $\frac{y}{f} = 2$ cuts curve (α = 15°) at *A*. It cuts vertical scales of

angular errors at *B*, *C* and *D*. Curve ($\alpha = 15°$) cuts lines $\beta = 40°$, 30°, and 20° at *E*, *F*, and *G*. Line $\frac{y}{f} = 2$ cuts the same lines at *H*, *J* and *K*.

Now we see that while the steering wheel moves from $\beta = 20°$ to $\beta = 40°$, the intersection of the steering knuckle axes traces the curve *GFE*. If there is to be no angular error in the position of the opposite wheel the point *P* should trace line *KJH*.

The angular errors in this problem are obtained as follows: Project *KG*, *JF*, and *HE* horizontally on to vertical angular error scales $\beta = 20°$, $\beta = 30°$, and $\beta = 40°$ respectively and obtain the intercepts *BL*, *CM*, and *DN*. Measuring these intercepts on the error scales discloses the following:

Intercept $BL = 3.13 - 2.13 = 1°$
Intercept $CM = 5.7 - 4.2 = 1.5°$
Intercept $DN = 8.2 - 6.6 = 1.6°$

These readings are to be interpreted as follows: Steering wheel in position $\beta = 20°$, angular error of other wheel $= \varepsilon = 1°$; steering wheel in position $\beta = 30°$, angular error of other wheel $= \varepsilon = 1.5°$; steering wheel in position $\beta = 40°$, angular error of other wheel $= \varepsilon = 1.6°$.

How can this design be improved? Evidently by reducing the angular errors. Suppose we choose an angle α so that *F* will fall at *J*. This angle would be $\alpha = 20\frac{1}{2}°$. This would give fairly small angular errors for the steering wheel positions $\beta = 20°$ and 40° and no error for $\beta = 30°$.

Since the range of action of the steering wheel, when one is weaving back and forth on a bad road or street, seldom reaches $\beta = 20°$, we may fairly assume that it will be best to change this design so that *G* will fall at *K*. In that case we will have to make $\alpha = 22\frac{1}{2}°$.

The writer believes that the judgment of engineers will fall between making *F* lie at *J*, or *G* lie at *K*. The angular errors when β is less than 10° are so small as to be negligible, even though they are active for longer periods.

The range of proportions which can be studied with reference to the curves 12-22, Fig. 3, is believed by the writer to include the majority of cases of passenger cars with tie rods placed behind the front axle.

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Zenith Carbureter Instruction Charts

THE Zenith Carburetor Co., Detroit, Mich., has issued a set of four charts illustrating the principle of the Zenith compound nozzle. These charts are specially suitable for instruction purposes, as they are of large size (17 by 22 in.) and printed in black and red. Chart No. 1 illustrates the single-jet carbureter; chart No. 2, the Zenith constant-flow device; chart No. 3, the Zenith compound nozzle, and chart No. 4, a section of the complete carbureter. The explanations to the charts are contained in a booklet entitled "The Compound Nozzle Explained," which is issued by the company.

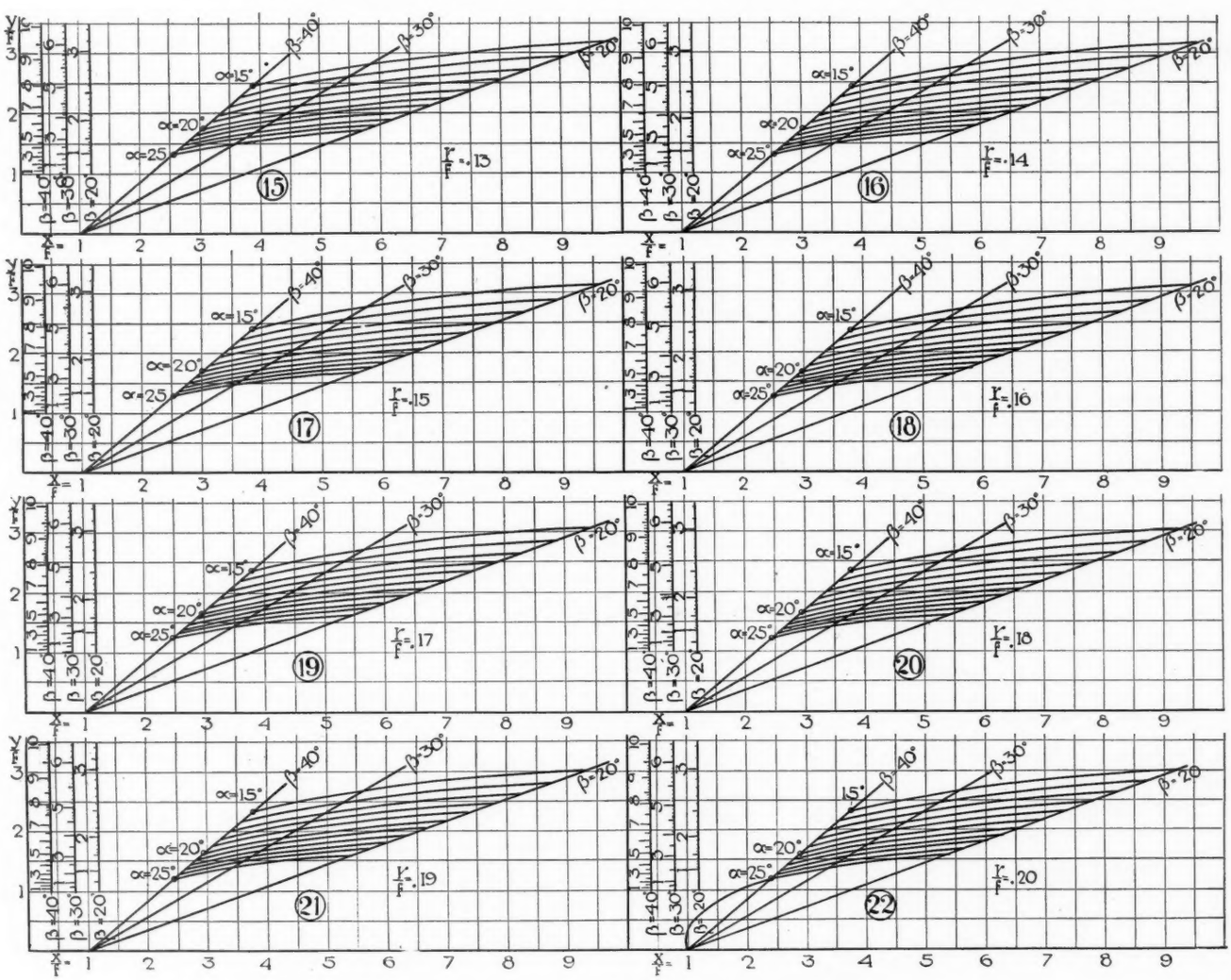


Fig. 5—Angular error curves for various steering conditions

Japanese Market Develops Slowly

Manufacturers Must Not Insist on Large Allotments Despite 60,000,000 Population—Wide Opportunities for U. S. A. Cars, But Dealers Must Not Be Overloaded

By Hi Sibley

OUR manufacturers must realize that the automobile and motor truck market in Japan, while promising to eventually develop amazingly, is at present limited and cannot be rushed. When the sales manager of a large American manufacturer receives a request for the sole agency in Japan for his product from a dealer in that country he usually looks up the population of the empire. When he sees that this is 60,000,000 he promptly jumps to the conclusion that there must be a very large field for his vehicles. Whereupon he dictates a letter to the dealer informing him that he may have the exclusive selling rights in that country if he will contract for 2000 cars the first year, 3000 the second, and so on.

When the dealer opens the letter he smiles sadly and observes, "I wonder when those Americans ever will become educated to the conditions out here." And he wearily replies, as he has replied to scores of other benighted American sales managers, trying to convince him that Japan is no automobile Golconda at present, but that with a modest beginning and much patience on the part of the dealer, that particular car will eventually develop a very satisfactory market for itself.

Motor taxi sign at the Shimbashi station, next to largest in Tokyo

It is true that there are 60,000,000 persons in Japan, but their potential buying possibilities are only a tenth of an equal number of Americans. Japan has been poor, but she is rapidly getting rich; in fact, is rich to-day, comparatively. And then again, the automobile is young in Japan, and has not yet been received with any infectious enthusiasm, but that time is coming soon.

Therefore, if the American automobile manufacturer is seriously seeking Japan as a future market, he should observe the following suggestions:

1—Be prepared, for the present, to turn over the sole agency on a contract for a moderate number of cars.

2—Place the agency in Tokyo, which is now and always will be the automobile center.

3—Make a nominal advertising allowance, for the dealer, to reach prospects most effectively, must have his literature all translated into and printed in Japanese.

4—Make as prompt deliveries as possible, for from 4 to 5 months is consumed in transit.

5—Include a certificate of origin with the shipping documents for each car shipped. This is imperative, for without it the importer must pay 50 per cent instead of 35 per cent.

6—As soon as the business warrants, be prepared to ship a stock of repair parts on consignment, assuming your dealer is responsible. After paying first cost on cars for stock, with the duty and at present excessive freight, the dealer does not feel like carrying and probably will not carry a full line of repair parts. It is much to the manufacturer's interest that repair parts are on hand, for deliveries are so late that rather than wait for a new part from the factory, the owner will have the old one repaired, or a copy made; but with all respect for the Japanese aptitude at making copies, they cannot possibly be so satisfactory as a factory made part, to the detriment of the car and its local reputation. A certificate of origin should accompany the repair parts also,

Porter who meets trains and solicits patronage in English or Japanese for taxicab company

Motor Taxi Cab Co.'s garage, headquarters for three smaller places. Has ninety cars in operation. All are Fords and for taxi service and meter rates only

for without it the importer must pay 30 per cent duty instead of 25 per cent.

With these points in mind and connection made with a reliable concern, there is no reason whatever why an average American automobile should not become established in popularity in this country, for in the next 5 years Japan undoubtedly is going to be the equal of any market in the Far East. China and the Philippines have exceeded her up to the present, but with her restless aggressiveness she is not going to be content to permit any other nation to pass her on this side of the globe.

Taxicab Companies Grow

One of the most reliable indications that the motor car is getting a hold on this little people is the rapidly growing business of the taxicab companies. Five years ago the Motor Taxi Cab Co., Ltd., of Tokyo, started in business with six cars at the railroad station. For the first 2 years it looked like a losing venture, for the Japanese only rode in them as a novelty, and after their first ride their curiosity was satisfied. Once a customer did not mean "always a customer"; rather the reverse. At the beginning of the third year, however, the business showed a gradual but substantial increase. To-day this company is operating ninety Ford taxicabs and has thirty more on order. In a visit to four principal railroad stations with Mr. Shobayama, manager, the writer did not find more than three cars at any one stand, where ordinarily there are from fifteen to twenty to take care of patronage. However, this is the cherry blossom season, when everyone takes a holiday and spends more freely than at other times.

Tokyo is the headquarters for all automobile sales agencies. There are seven in this city at present—four Japanese and three American importers. Some of them have small branches in other large cities, such as Osaka, Kobe, Kyoto and Nagoya. Yokohama is only 18 miles from Tokyo and is the best market outside of the capital, but has only one or two dealers, as the city can be more conveniently covered from Tokyo.

Usually a Side Line

With one or two exceptions the sale of automobiles is but a branch of a general importing business, and generally only the larger and more responsible concerns indulge in automobile sales agencies, which up to very recently have been more or less of a precarious adventure.

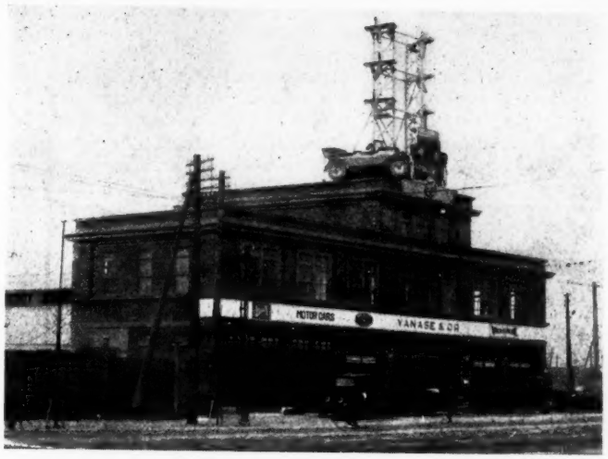
Sale & Frazar, an English-American firm, have done the largest business in motor cars in Japan, having imported over 400 Fords, which is the greatest number of any one make in the country. This firm also represents the Hupmobile and the Scripps-Booth. At times they have had as many as forty to fifty Fords in stock. The Yanase Garage, one of the largest importers of automobiles exclusively, is doing a very satisfactory business in Buicks, which has become one of the most popular American cars in Tokyo, second, of course, to the ubiquitous Ford. The Japan Automobile Co., exclusive importer, has very substantially established the Maxwell and Hudson in Japan.

Display rooms are not very numerous; in fact, they could be counted on the fingers of one hand. Considering the status of the automobile at present, however, these few are very creditable establishments, with new cars on exhibition in the front rooms of the place, and with garage space in the rear and well-equipped machine repair shops in charge of Japanese mechanics and foremen. Three of them have their own body-building departments for turning out bodies adapted to Japanese requirements.

Body building is a rapidly growing industry and almost half of the cars imported are purchased chassis only. This effects a considerable saving in freight, which since the war has been a formidable item of expense. Rates have fluctuated a great deal in the last 3 years; the freight on a Ford at one time was $400, more than the original cost of a car, but the chassis now are coming from America for approximately $90 each. The pre-war freight on a Hupmobile was $125, while now it runs from $200 to $225 for the chassis. A Maxwell complete car costs about $210 freight from Detroit.

By shipping without bodies the transportation charges are decreased from $50 to $150, and with the allowance made at the factory for the bodies, the purchaser has a fair sum saved toward a custom made, Japanese body more to his taste. These latter cost from $200 to $600, and with the Japanese creative genius for the beautiful, many cars, commonplace in appearance, are made ultra-smart. It is difficult for the observer to classify at a glance many cars with which he is familiar in America, for the original lines are so cleverly concealed.

The most popular type of body is the small limousine, with black or occasionally a dark blue finish, and thin gold stripe. Interiors are invariably done in light tan whipcord, and the whole job, in appearance, is the equal of the best American work. With their consummate taste in delicate



Yanase garage, Buick representative. Building extends back about 200 ft. and has modern machine repair shop and body building shops. Thirty bodies a month are turned out here, some of them remarkably handsome in appearance

Fujiwara Shokai Co., which represents Packard, Paige-Detroit and Chevrolet. This concern also builds bodies

Japanese-built body of modern design mounted on Buick chassis

works of art and their traditional skill in producing lacquered work, the Japanese cabinet makers have lived up to their reputations in turning out these handsome bodies.

The only two objections to the Japanese-built body are the weight and, in rare cases, mechanical shortcomings, such as allowing too small space for the free manipulation of the gearshift, or bringing the seat too far forward for leg comfort. However, as all Japanese-owned cars are driven by native chauffeurs, who are much shorter in stature than the average American or Englishman, this last is no serious oversight. The five body-building shops visited turn out about fifty jobs per month.

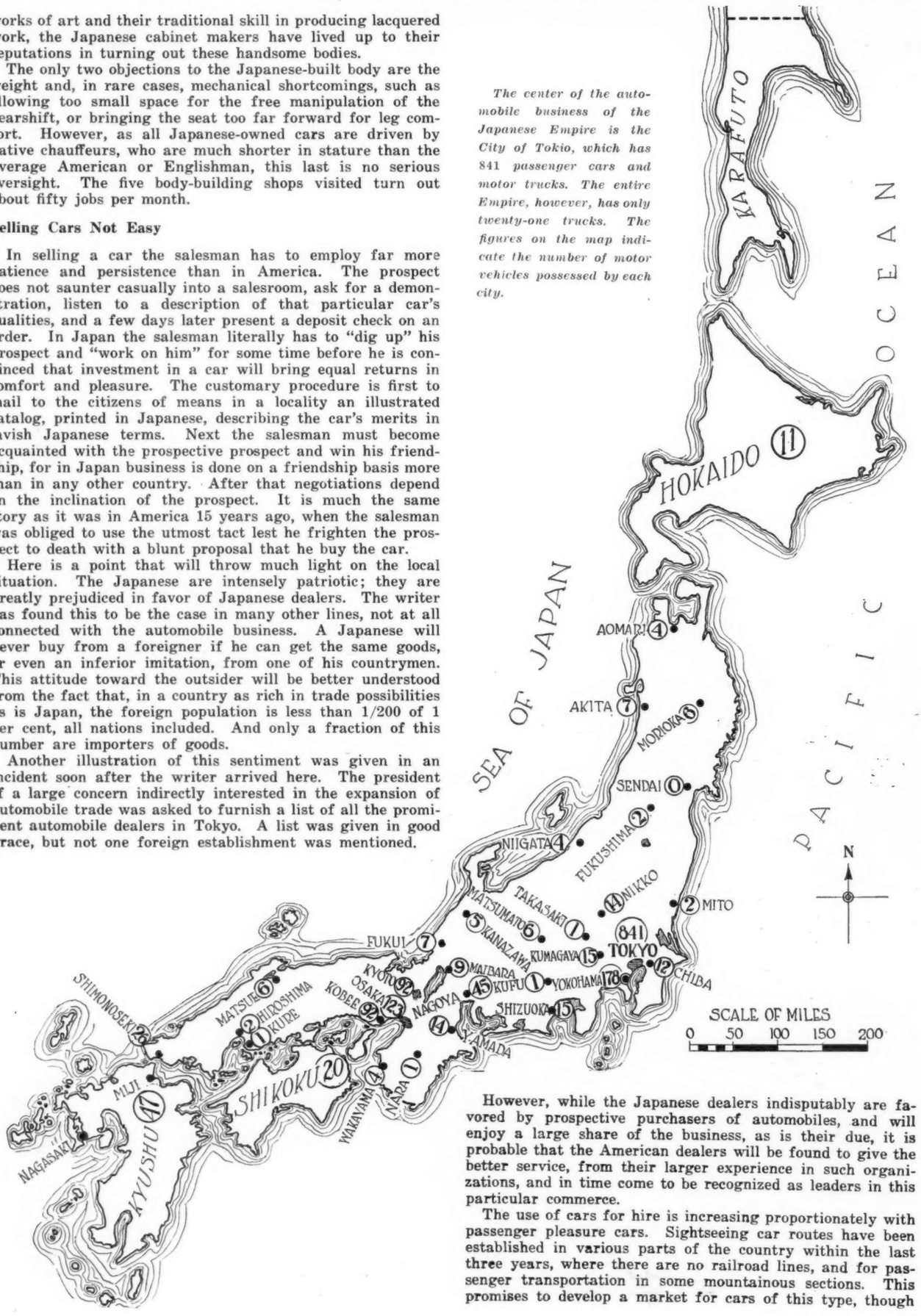
Selling Cars Not Easy

In selling a car the salesman has to employ far more patience and persistence than in America. The prospect does not saunter casually into a salesroom, ask for a demonstration, listen to a description of that particular car's qualities, and a few days later present a deposit check on an order. In Japan the salesman literally has to "dig up" his prospect and "work on him" for some time before he is convinced that investment in a car will bring equal returns in comfort and pleasure. The customary procedure is first to mail to the citizens of means in a locality an illustrated catalog, printed in Japanese, describing the car's merits in lavish Japanese terms. Next the salesman must become acquainted with the prospective prospect and win his friendship, for in Japan business is done on a friendship basis more than in any other country. After that negotiations depend on the inclination of the prospect. It is much the same story as it was in America 15 years ago, when the salesman was obliged to use the utmost tact lest he frighten the prospect to death with a blunt proposal that he buy the car.

Here is a point that will throw much light on the local situation. The Japanese are intensely patriotic; they are greatly prejudiced in favor of Japanese dealers. The writer has found this to be the case in many other lines, not at all connected with the automobile business. A Japanese will never buy from a foreigner if he can get the same goods, or even an inferior imitation, from one of his countrymen. This attitude toward the outsider will be better understood from the fact that, in a country as rich in trade possibilities as is Japan, the foreign population is less than 1/200 of 1 per cent, all nations included. And only a fraction of this number are importers of goods.

Another illustration of this sentiment was given in an incident soon after the writer arrived here. The president of a large concern indirectly interested in the expansion of automobile trade was asked to furnish a list of all the prominent automobile dealers in Tokyo. A list was given in good grace, but not one foreign establishment was mentioned.

The center of the automobile business of the Japanese Empire is the City of Tokio, which has 841 passenger cars and motor trucks. The entire Empire, however, has only twenty-one trucks. The figures on the map indicate the number of motor vehicles possessed by each city.



However, while the Japanese dealers indisputably are favored by prospective purchasers of automobiles, and will enjoy a large share of the business, as is their due, it is probable that the American dealers will be found to give the better service, from their larger experience in such organizations, and in time come to be recognized as leaders in this particular commerce.

The use of cars for hire is increasing proportionately with passenger pleasure cars. Sightseeing car routes have been established in various parts of the country within the last three years, where there are no railroad lines, and for passenger transportation in some mountainous sections. This promises to develop a market for cars of this type, though

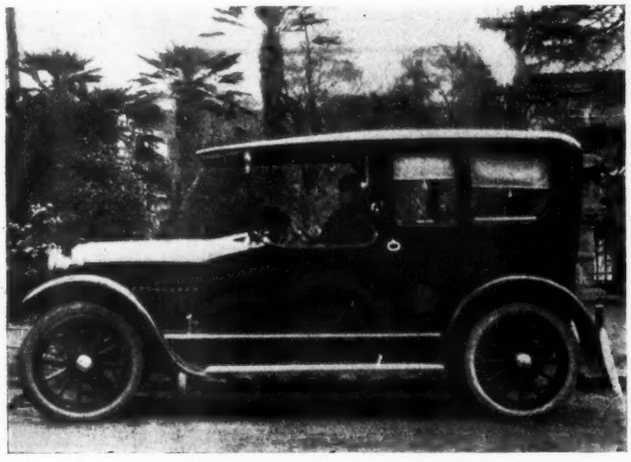
at present most of the cars in use are Fords with a special body with two rear seats, carrying eight with driver, and small buses mounted on light chassis. New lines and cars are being added each season, and with the taxicab, they promise rapidly to popularize the automobile.

The jitney bus has not yet made its appearance, and it is doubtful if it will for some time, as street car lines with 5 sen—2½ cents—fare cover Tokyo pretty thoroughly, as well as other cities, and the price of gasoline is almost prohibitive.

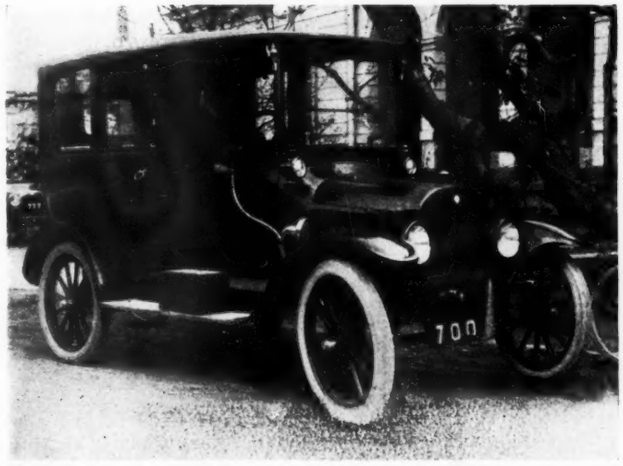
Taxicab stands are located at the principal railroad stations, the Tokyo, Shimbashi and Uyeno, and here uniformed porters employed by the taxicab companies solicit patronage from incoming trains, in both English and Japanese.

Touring cars and inclosed cars for hire are much in demand, and the greater the capacity the better. These pick up most of their passengers in the theater and tea house districts, for the Japanese, in spite of their thrift, are a pleasure-loving people and periodically go forth to have a high time.

As for garage storage or care of privately-owned cars in a public garage, no permanent rate has been established, since the owner rarely gets so far away from his home that he cannot get back the same night. A car goes into a public garage—if it could be termed that—only for repairs, or repainting, or adjustment. There is some room for improvement in car repairing, by the way, and more attention is given to the appearance of the car than to its often loudly-complaining vitals. Some of the smartest and sleekest limousines on the streets give forth clanks and knocks which grate harshly on the American ear, attuned, as it is, to the smooth running motors on our Michigan Avenues and Riverside Drives.



Japanese body on Paige-Detroit



Another style of Japanese built body on Ford

A taxicab garage housing twenty-five Ford taxis, opposite the Ichimuraza Theatre. A lucrative location

Small garages like these are found all over the city, housing cars for hire

Concerning repairs and adjustments, however, it must be borne in mind that this trade is a new one for the Japanese mechanic. What he knows he has learned from experience rather than from precedent, and the writer's observations lead him to believe that the Japanese mechanic is not yet thoroughly familiar with motor anatomy and its functions.

AUTOMOBILE DEALERS IN TOKYO, JAPAN

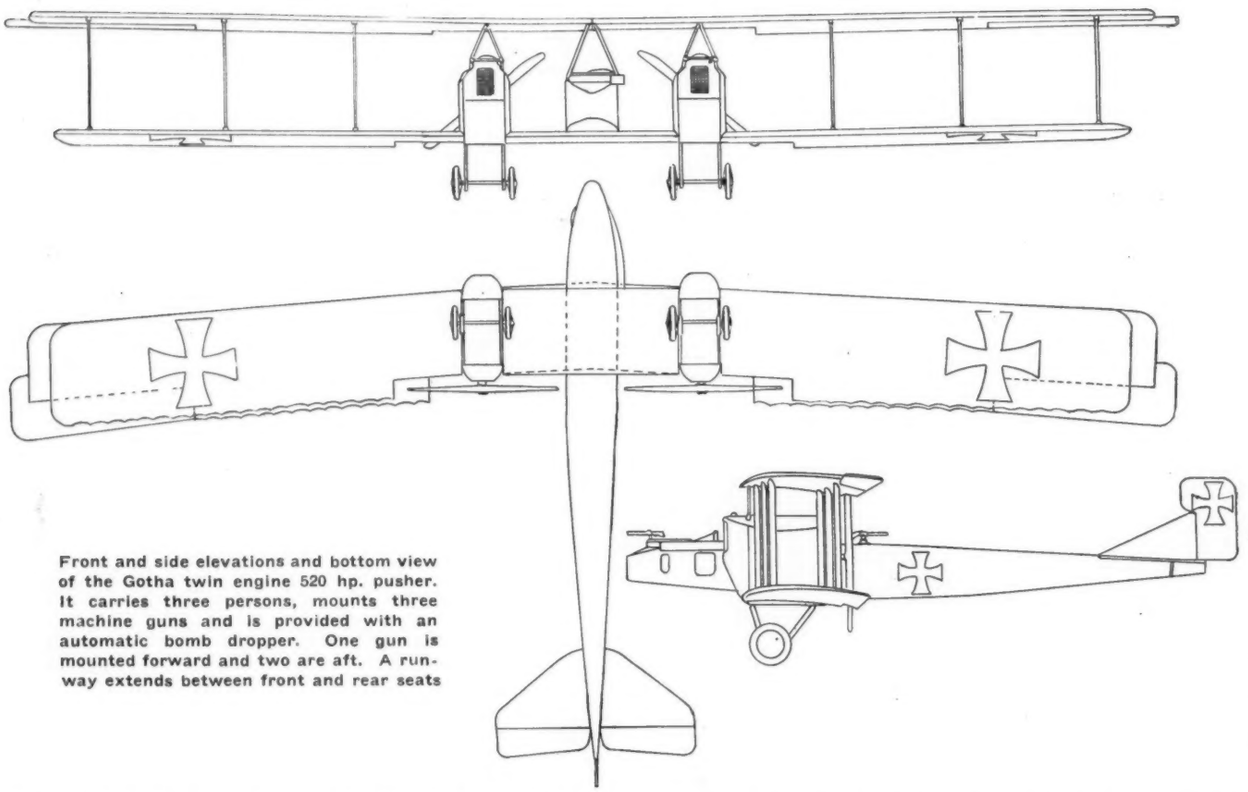
Firm Name	*Representing*	*Branches*
Sale & Frazar	Ford Hupmobile Scripps-Booth	Yokohama Osaka Nagoya Moji Keijo Dairen
Andrews & George	Cadillac Overland	
F. W. Horne	Chalmers	Osaka, etc.
Yanase Garage	Buick Wolseley—English	
Nippon Jidosha Kabushiki Kaisha (Japan Automobile Co., Ltd.)	Maxwell Hudson F. I. A. T. Daimler	
Fujiwara Shokai	Packard Paige-Detroit Chevrolet	
Yamaguchi Katsuzo Shoten		

Cities	*Population*	*Number of Cars in Vicinity*
Tokyo	2,250,000	841
Osaka	1,300,000	123
Yokohama, seaport	394,000	178
Kobe, seaport	380,000	92
Nagoya	378,000	45
Kyoto	442,000	9
Nagasaki, seaport	176,000	9
Hiroshima	142,000	3
Shimonoseki, seaport	58,000	26
Moji, seaport	.....	29
Island of Hokkaido	.....	11
Island of Shikoku	.....	20
Island of Kyushu (includes Nagasaki and Moji)	.....	47

The total number of motor cars in Japan, including trucks, is 1656. Population of Japan, 62,000,000.

The Gotha Twin-Engine Military Plane

Of the Pusher Type, With Two 260 Hp. Mercedes Engines—Mounts Three Machine Guns and Carries Three Passengers Besides a Supply of Bombs



Front and side elevations and bottom view of the Gotha twin engine 520 hp. pusher. It carries three persons, mounts three machine guns and is provided with an automatic bomb dropper. One gun is mounted forward and two are aft. A runway extends between front and rear seats

ONE of the largest fighting and bomb throwing airplanes yet produced in Germany is the Gotha twin-engine three-passenger machine, of which a description appeared in the June 15 issue of *L'Aerophile*. It is the product of the Gotha Carriage & Airplane Wks., and a number of these planes took part in the recent raid on London, from which it will be seen that it is of the long range type. *L'Aerophile* thinks that some features of design were borrowed from the British Handley-Page 500 hp. biplane, of which one was captured by the Germans at Lille.

The main planes are nearly equal, with an overhang of the ailerons. The planes are slightly arrow shaped, the edges slanting rearwardly from the axis of the machine, but their form is nearly rectangular. A large section is cut out at the rear, however, to make room for the propellers. The rudder, with the plane stabilizer, is semi-hexagonal in form. The body is built to rest on the lower wings and is of rectangular section. Its front is of three ply construction. Machine guns are mounted in front and rear, and there is a tunnel through the body which permits of shooting rearwardly and downwardly with one of the machine guns. There is a runway between these guns. Three bomb throwers are also mounted and a total of fourteen bombs can be carried.

The undercarriage consists of one pair of wheels under each of the engines. These are both of Mercedes make, developing 260 hp. each, and drive two propellers at the rear of the planes. The use of rear mounted propellers seems to be a reversion in type, as tractor type machines have been almost universally used in Germany since the beginning of the war. The total length of the machine is 41 ft., the total height 12.6 ft. and the span of the lower wings 72 ft. The span of the upper wings, including the ailerons, is 77.7 ft. There are ailerons only on the upper wings. The upper wings are slightly deeper than the lower ones, the former being 7.5 ft. and the latter 7.2, and they narrow down gradually. The distance apart of the wings is slightly over 7 ft. The total surface of the wings is practically 1000 sq. ft.

The main planes are slightly W-shaped, the tips of the wings being higher than the inner ends, and they are also slightly arrow-head shaped. In their nearly rectangular contour a large recess is cut at the rear in which the propellers revolve. In addition there is an overhang of the ailerons at the end, which from a distance gives the appearance of a rectangular cutout at the outer end of the forward edge of the wing. The enormous ailerons are compensated by a rectangular plane in front of their pivot. The span of the ailerons is 12.6 ft. Over a length of 11 ft. their depth increases from 2.2 to 2.7 ft., over a length of 1.57 ft. the depth is 4.33 ft., as the compensating plane has a depth of 1.64 ft. over a length of 1.57 ft. The area of each aileron is 30 sq. ft.

The upper main plane is made in two halves which are attached to a central cabane. The lower main plane is made in three sections, of which the central section, which is rectangular in shape, extends from the inner wall of one engine nacelle, underneath the body of the plane to the inner wall of

the other engine nacelle. The engine nacelles with the fuel tanks extend slightly below the lower main plane.

The main spars are of I section with reinforced flanges. These are interconnected by tubular ribs. As these ribs are arranged at right angles to the spars they form a slight angle with the line of flight. This disposition also has the effect of offsetting the interplane struts, the front and rear ones of which are not in line.

The fixed stabilizing plane consists of two nearly triangular parts. The two movable volets are slightly trapezoidal, widening from the axis to the outer end. The rudder supporting plane, which is of elongated triangular form, extends to the end of the body, and directly behind it, that is to say, overhanging the body, is the steering plane. The whole assembly affords a striking appearance.

Plane Body of Unique Construction

Of unique construction is the body of the plane, which is of rectangular section. It comprises a three-ply nacelle, which extends prominently forward. Its four longerons are made of ash, as are the struts used in their construction. The cockpit is not arranged symmetrically. The front passenger is seated near the axis of the machine, but the pilot with his control members, including a hand wheel with sprocket and chain and a control column, is placed over to the left, leaving a passageway on his right, a sort of runway through which the gunners can pass from the front to the rear. Behind the pilot there is room for two bomb releasers, and then comes the seat of the rear passenger, back of which a tunnel extends downwardly and rearwardly through the body. Behind the seat there are two transverse tubes, mounted in the Aviatik style, which support two machine guns, one being placed above the body and the other so as to permit of shooting downward.

The landing gear consists merely of two wheels under each engine, the axle of which is mounted on two tubular V's. These tubes, of course, are of streamline section. The engines are arranged in two spacious nacelles, at 6.9 ft. from the axis of the machine. These nacelles have a tubular frame-work, which is surmounted by cabanes and covered with sheet metal.

Two Mercedes Engines Used

Two Mercedes engines of 260 hp. each are used. These are of the six-cylinder vertical tandem type with the cylinders made singly and their waterjackets connected together by joints. There is a slightly greater distance between cylinders Nos. 3 and 4 than between the other cylinders. This engine is of different construction from the 235 hp. eight-cylinder Mercedes, but, like the latter, is based on 170 hp. engine of the same make, having the same chief characteristics. On some monoplanes this engine is fitted with a front propeller. Exactly the same engine is used on the Gotha, except that it is turned around, the propeller being at the rear and the plane of the pusher type.

Each cylinder is similar in appearance to one of the 175 hp. engines. The waterjacket of each cylinder is connected by a joint to the jacket of the adjacent cylinder, and each cylinder is separately secured to the crankcase. The cylinders have a bore of 160 mm. (6.3 in.) and a stroke of 180 mm. (7.09 in.), and the engine develops from 258 to 260 hp. at 1400 r.p.m. The hourly consumption is equal to 76 liters (20 gal. of gasoline) and five liters (1.32 gal.) of oil. On this model a single carbureter is installed, instead of the dual or two combined carbureters on the 170 hp. engine and the two separate carbureters on the 235 hp. The carbureter is located at the forward end of the engine and draws its air through the crankcase, which tends to heat the mixture and to keep the crankcase cool. A single inlet pipe of enormous size extends from the carbureter. Two magnetos are fitted, one on each side of the vertical shaft connecting from the crankshaft to the camshaft, which latter extends horizontally across the tops of the cylinders.

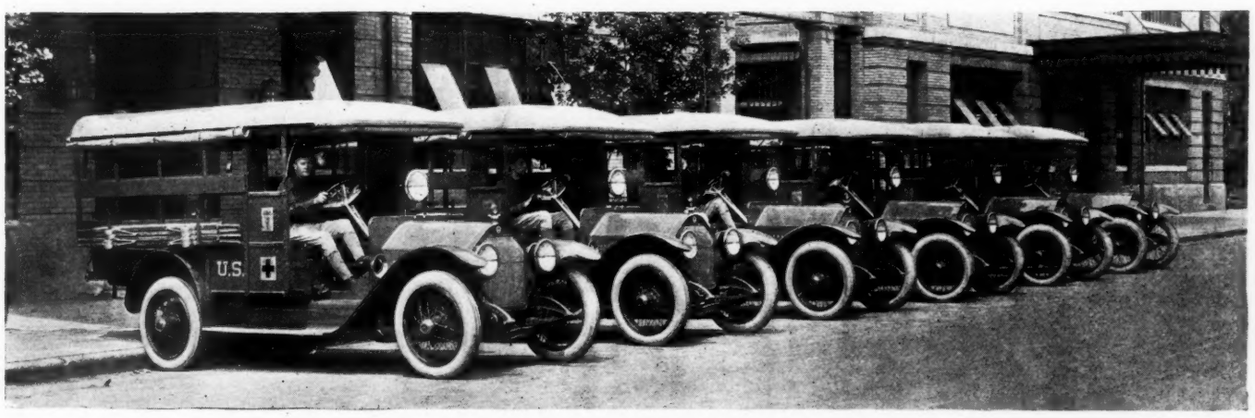
Four Valves in Each Cylinder

Instead of the two valves of the other engines, there are four valves in each cylinder, with tappets, springs and camhousings substantially similar to those used on the 175 hp. engine, except, of course, that all of these parts are duplicated. There are two spark plugs in each cylinder. Above the camshaft at the propeller end of the engine is located the air pump, and at the opposite end there is a compression relief mechanism with a hand lever, the same as on the 175 hp. engine. To facilitate starting, the camshaft is displaced by turning the hand lever to the side, which throws in play small cams located opposite the exhaust cams which keep the exhaust valves open during part of compression stroke, thus reducing the compression. The crankcase, which serves as the base of the engine, is made in two parts and is of the same general design as in the 175 hp. engine. A radiator of the honeycomb type is fitted at the front end of the engine, with an oil tank underneath. The fuel tank is located underneath the engine support.

In the way of armament these planes carry three machine guns. One is mounted in front on a revolving support, which permits of sweeping the whole hemisphere limited by the forward edge of the planes, as well as shooting slightly to the rear both upward and downward. One of the guns is on a mounting of the Aviatik type, sliding on a transverse tube almost flush with the top of the body, behind the rear passenger. With this gun the gunner may shoot to the sides and almost perpendicularly downward, and when in retreat, even upward, by the gunner kneeling on the floor of the cockpit. He can, however, not shoot in the direction of the tail.

A third gun is on a similar mounting, sliding on a transverse tube at the level of the cockpit floor.

Six Ambulances Presented to Indiana National Guard



Six ambulances presented to the Indiana National Guard by the Stutz Motor Car Co. and the Parry Mfg. Co., Indianapolis, as they appeared drawn up before the Stutz factory before being taken over by the military authorities. The chassis are Stutz and the body work is by the Parry company

New Ensign Kerosene Carbureter

Vaporization of Fuel Effected by Burning Heavier Elements of the Kerosene in a Heating Chamber —No Preheating of Air and No Jacketing Used

FITTING a spark plug in the carbureter and having a spark pass through this plug in order to burn the heavier fuels and thereby heat the mixture and aid in carburetion is the new principle employed in the latest model of the Ensign kerosene carbureter, built by the Ensign Carbureter Co., Los Angeles, Cal. This latest Ensign type N uses no other means of heating the air for the kerosene than by partially burning a part of the mixture in what is called a firebox in the carbureter. This firebox does not correspond with the mixing chamber, but is located below it so that the heated air and mixture from the firebox rise through a standpipe and go directly past the throttle. No other method of heating air is used. There is no hot air pipe from the exhaust manifold, not even a jacketing of the carbureter, so that in the coldest days unheated outside air is used to vaporize the kerosene. Gasoline is used for priming purposes, there being incorporated in the carbureter a gasoline supply higher up than the float chamber, which handles the kerosene so that the gasoline can be dripped by gravity past the kerosene, so to speak, for starting.

Use of Spark Plug to Explode Kerosene New

This step of using a spark plug to explode and partially burn the heavier kerosene elements is new with O. H. Ensign, who has spent years in developing carbureters to handle the distillate of California and later to handle kerosene.

The sectional illustration shows how the spark-plug method is used. In the bottom of the carbureter is the firebox J, a circular chamber with what is termed a distilling table K, an umbrella-shaped metal piece forming the top of the firebox. The position of the spark-plug is shown and this plug is connected in series with one of the spark-plugs of the engine so that in a four-cylinder engine there is a spark in the firebox with every fourth spark of the engine. The spark-plug in the carbureter is in reality a spark gap in series with one of the spark-plugs.

How Carbureter Works

Here is how this carbureter works: The kerosene supply is carried in the float chamber H, being float controlled as in the conventional carbureter. In a separate chamber higher up is carried a supply of gasoline P for priming purposes. This gasoline chamber is filled by a primary lever, and the contents flow through the nozzle and into the air current by gravity.

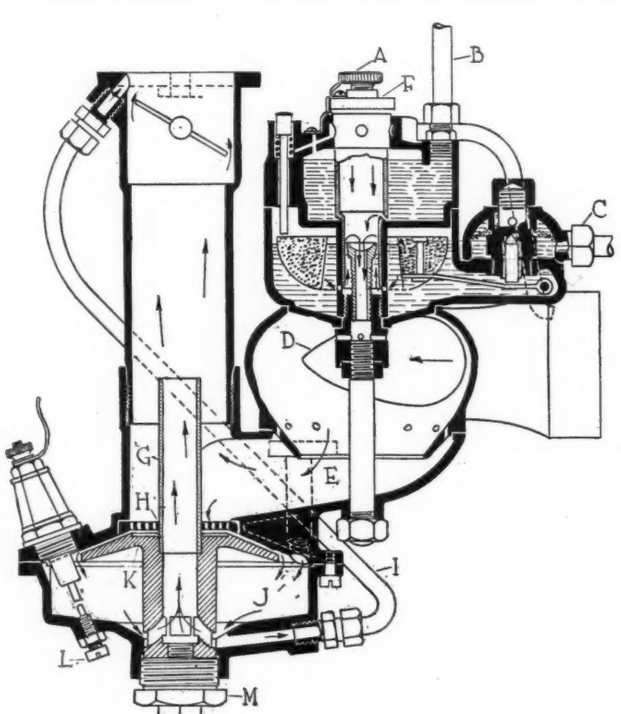
Kerosene flows from the float chamber as indicated by the arrows down through the four openings into the mixing chamber D. This chamber is open at the bottom so that the heavy kerosene falls through the bottom opening and falling on the curved surface R flows downward to a baffle plate or fire screen H. Here it falls through the openings in the screen and drips onto the top of the distilling table K and begins to flow down its inclined surface, into the firebox, where it is ignited by the spark gap. Partial combustion occurs causing the production of what is claimed to be a fixed gas, which is drawn from the firebox up the vertical passage G, back into the main stream of air from the mixing chamber up past the throttle. Soon the distilling table K becomes heated. The heat from the combustion in the firebox extends up to the throttle and beyond into the manifold so that after 3 seconds running it is claimed that the firebox is well heated, and that in 8 to 10 seconds the intake manifold above the throttle is hot so as to maintain the uniformity of carbureted fuel to the cylinders. The immediate heat which the carbureter thus produces is claimed to make the use of kerosene in the coldest weather quite easy.

Following the operation of the carbureter further: All of the air enters through one opening in the side of the mixing chamber D, the opening being tangential so that a downward whirl is imparted to it, which carries the kerosene from the spraying nozzle. Once through the bottom of the chamber C this air laden with kerosene vapor and kerosene globules divides, part going directly above the standpipe G and past the throttle as indicated at S, part going down into the firebox at T (the latter is a relatively small amount) and part entering a bypass, E, which has a tangential opening into the firebox, thereby causing a rotary motion in the firebox of the flaming fuel. This aids in giving a more uniform mixture. The air entering the firebox through E is relatively free of fuel. It takes up the kerosene that drips off the distilling table. This completes the carbureter process, the lighter kerosene particles being carried direct as indicated by arrows S and the heavier particles getting into the firebox before passing to the engine.

Temperature Regulation

Now for temperature regulation: The temperature is regulated by raising and lowering the distilling table K with relation to the firescreen H by means of the adjustment M. This chokes the extension of the table, thus reducing the draft on fuel and air at this point. When the throttle is at the idling position illustrated the idling bypass tube I draws out from the extreme bottom of the firebox all fuel which has flowed to that point unconsumed. Under wider throttle opening the fuel is drawn up through the gas passage G.

At first starting with the carbureter when cold all of the fuel passes through the firebox. Soon the distilling tables



Sectional view through Ensign carbureter, showing single air inlet, heating chamber, location of spark plug, etc.

become heated so that the more volatile elements are distilled therefrom and the vapors thus generated cause resistance to the flow of other than the heaviest bodies through the holes in the firescreen H and the firescreen itself becomes heated. Soon the pipe G is also so heated that all lighter particles of the fuel are highly vaporized and the heavy particles only flow into the firebox to be partially burned.

At full power a certain amount of atomization will take place in the carbureter which is turned into vaporization upon striking the gas passage G and mingling with the hot gases therefrom so that still less fuel in proportion to the total quantity flows through the firebox at full load, whereas practically all of it flows through the firebox when idling on account of the extreme suction applied when idling.

Wide Range of Temperatures

This results in a claimed wide range of temperatures. For example: The apparatus may be constructed and adjusted to give an idling temperature of 250 to 300 deg. in the manifold and an operating load temperature from 170 to 198 deg. under full load in the manifold. Upon closing the throttle after a full-load run but a few seconds are needed to cause this temperature to change to the higher temperatures needed for idling.

This results in wide flexibility with a very small call upon the gasoline, so that a half-gallon priming tank is claimed to last for several days, requiring only a couple of ounces to make a cold start and a less quantity to make a start after the motor and carbureter are warm. In summer a start may be made on kerosene after a 15-min. stop.

Starting on gasoline is as follows: By a toggle primer, not contained in the illustration some of the gasoline flows as indicated by arrows into the nozzle and thence down through it and into the air current in D. If there should be any heavy particles they find their way into the bottom of the firebox and may be sucked through the priming bypass tube I above the throttle.

In action this ensign model is automatic as already explained, in that the more heavy units there are to get into the firebox the more are burned there and the more heat is produced through the carbureter and the manifold. Again with more volatile fuel there are fewer heavy particles to get into the firebox, less burning there and less heat generated. In this way gasoline can be used in this carbureter, in which but few heavy particles would reach the firebox and the temperature of the carbureter and intake would be accordingly lower.

Engine Pounding Eliminated

The motor is claimed to go into full action without any hesitation and by the time the gasoline in the chamber P is exhausted full power may be obtained from the kerosene. This Ensign model is essentially a heat carbureter, but it produces its own heat within the carbureter by the burning gas.

No water injection into the manifold has been used and the engine pounding which is a problem with using kerosene, and which pounding is counteracted by the use of water, does not take place. Mr. Ensign is of the belief that the fixed gas coming from the firebox, not claimed to be a completely combusted gas, plays a part in the elimination of engine pounding.

Miller "Double Flow" Poppet Valve

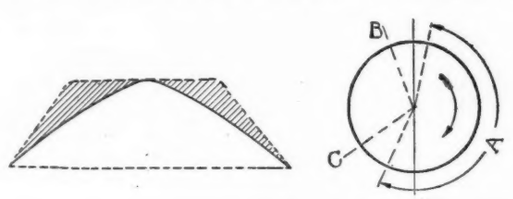
R. MILLER, secretary of the Reliance Motor Boat Co. of New York, has designed a modified form of poppet valve, which permits of very rapid opening and closing, thus increasing the capacity of the valve for passing gas. The valve consists of a standard poppet valve having a short skirt on the periphery of its head, separated therefrom by a couple of short bridges so that there is a clear passage between the skirt and valve head. The skirt registers with a sleeve on the upper end of the valve stem guide and also with the lower edge of the valve seat.

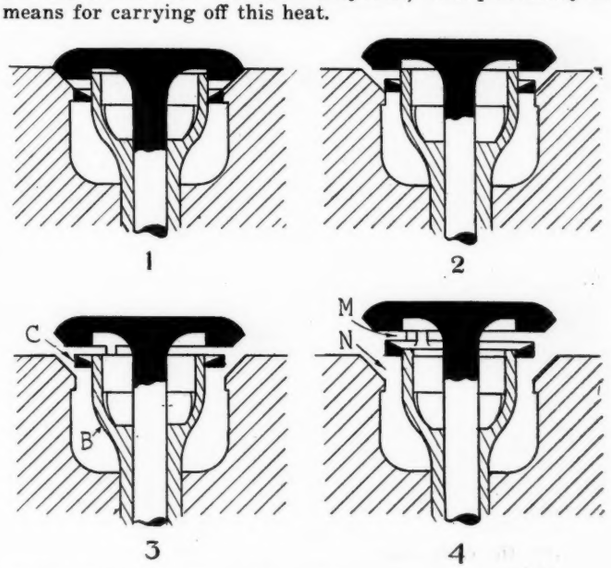
Considering an inlet valve, the action is as follows: During the compression, explosion and most of the exhaust stroke the poppet valve head is down on its seat, which is ground. About 30 deg. before the end of the exhaust stroke the cam begins to lift the valve head off its seat, and this lifting may take place as gradually as may be desirable for silent operation. No flow can take place until the upper edge of the sleeve B and the lower edge of the skirt C become uncovered. These two actions take place simultaneously as shown at 2. At this moment the piston in the cylinder is about to begin its suction stroke.

At 3 in the illustration the valve is shown lifted 1/16 in. higher than at 2. (The drawing is somewhat reduced from the original. The arrows show the double flow, through the skirt and around same. It is claimed that an equal amount of gas flows through both passages. At 4 the valve is shown fully lifted. The closing operations are in the reverse order.

The advantage of this valve construction lies in the fact that it gives a better timing for the flow. Usually the inlet period extends over 100 deg. of the cam revolution, and for quiet operation it is necessary to spread the lifting over 40 deg. and then closing the same, leaving the valve fully open for only 20 deg. If steeper cams and stronger springs are used to open and close the valve more rapidly, the valve action will be noisy.

It is claimed that with the double flow valve the mean opening area for the duration of the opening can be made more than 50 per cent greater, and that even more valve area can be secured than with multiple valves in I or L-head cylinders of the shapes and with the valve sizes and lifts now common. The complication of the valve and its increased weight are, of course, disadvantages. It also appears questionable whether the valve would be capable of giving reliable service as an exhaust valve, owing to the extreme heat to which the sleeve and skirt would be subjected, with practically no means for carrying off this heat.





Left—Opening diagram for Miller valve. Right—Successive stages of operation

Armored Cars Demoralize Retreating Enemy

Motor Vehicles Play Important Part in Carrying Out Observations from Captive Balloons—Italians Successfully Using Lancia Armored Car with Standard Chassis—Evinrude Engine in Trenches

By W. F. Bradley
Special Representative in Europe of
THE AUTOMOBILE AND AUTOMOTIVE INDUSTRIES

ARMORED cars have not been used on the Western front to anything like the extent popularly imagined by the American public. A little reflection, indeed, would have shown that with troops deeply intrenched, and a practically immovable line, there would be very little opportunity for using vehicles of this nature. It is only when one side gets the ascendancy, and the enemy is actually on the run, that the usual type of armored car can do really effective work.

One of the most successful types used by the Italians is a 35-hp. Lancia, with a four-cylinder engine of 4.3 to 5.1-in. bore and stroke. The chassis is practically standard, experience having shown that there is no need for a special construction for this class of work. It has neither double steering nor special reverse, being really the standard chassis, with electric lighting and starting, twin pneumatic tires at the rear and steel disk demountable wheels.

The body is special, and is not the work of the chassis maker. It has a single compartment with two revolving turrets mounted on ball bearings, the lower turret carrying two machine guns and the upper one a single gun. The whole car is armor-plated, the protection extending right over the engine and the radiator, and consisting of ¼-in. chrome-nickel steel capable of turning a rifle or machine-gun bullet at short range. The rear tires are incased so as to be practically bullet proof, but the front wheels are usually left without any protection, as it has been found that the steering is rendered heavy by this extra weight of metal directly over the front axle.

The interior arrangements are wonderfully compact and well thought out, the center of the floor being occupied by the round gasoline tank with the spare tires around it. The top of this housing serves as a very convenient platform for the gunners, and of course the tank is in a position where it is least likely to be hit. The driver is the only man who has a special seat. He is on the right side of the car, and has a variable lookout through the adjustable steel dash.

On his right is a lookout, with a mirror ahead of it, to be made use of for reverse driving. Practically no wood is used in the construction of these cars, everything being of steel, and the vehicle therefore is practically indestructible by fire. The driver has the whole of his instruments neatly mounted on the dash, and, although there is a starting crank, the electric starter is a very important if not an invaluable accessory. Most of these cars are fitted with optical telegraphy, and, of course, signal by code.

Six Men Used

It is usual to carry a crew of six men, all young volunteers selected for their experience in motoring and for their dash. While vehicles of this kind have nothing to fear from rifle bullets, and can withstand a considerable amount of shrapnel, it is most important that they be handled by men of nerve and experience if they are to be of use to their own army and are to keep out of the hands of the enemy. These men are specially trained to act quickly in all kinds of emergencies; particular attention is paid to practice in reverse driving at speed, with no other guide than a mirror placed on one of the wire cutters or the side of the car.

On good roads the cars can touch 53 m.p.h., and on long runs will easily average 25. While the driver and officer in charge must have dash, it is essential that the former be possessed of unusual judgment and skill, so as to know immediately what to do when the thousand and one unforeseen circumstances are met with. Practically the only thing these daring crews fear is allowing the car to drop into a hole or ditch so deep that it cannot get out under its own power. It depends on the driver to keep out of such positions. With the enemy wavering, or already in retreat, a few armored cars of this type have a most demoralizing effect. Where these cars operate in sections it is usual to have a similar car, without guns, for bringing up ammunition.

Help in Observation

Motor vehicles play an important part in carrying out observations from captive balloons. Each balloon has attached to it a special automobile—in the Italian army it is a 3½-ton Fiat truck chassis—with a powerful winding drum and 1100 yd. of steel cable. As the balloon, with observer's basket attached, is sent aloft, the engine pays out cable over the winding drum until the required height has been attained, when the car holds the balloon prisoner, but is ready at any moment to haul it down if weather conditions, an enemy attack, or accident render that necessary. The winding drum is mounted with its shaft horizontal, and the cable passes through a traveling block to provide for all movements of the balloon due to changes in the wind.

Sometimes by means of the same car, sometimes by another car, the observer in the balloon is connected with the ground. As each shot is fired, the observer up aloft reports the effect to the man in the cab, who immediately telephones it to the battery commander close by. One balloon can serve several guns or a series of batteries, hence the messages from aloft go first to the telephonist in the car, then to the battery commander. Guns and batteries are never far apart, but while the gun is in the most concealed position possible, sometimes in a hole only reached with great difficulty, the balloon must operate from a more or less open space. In the early days, horses were used for this work, but now the observation balloon service invariably relies on the gasoline motor.

When daylight fails the observation balloon's crew

ceases work. The engine is started, the winding drum put into motion, and the big gray gasbag slowly brought down, seized by a group of soldiers, and anchored for the night under a special canvas tent hung around with sandbags.

Searchlight Cars in Action

It is then that another car service comes into action. These are the searchlight cars, which during the day have been hidden away in some wrecked farm or courtyard, or have been buried under a thick covering of tree branches. The commonly employed type on the Western front is a 30-hp. car with a 36-in. projector. The Italians make use of a Fiat chassis almost exclusively; the French employ various makes. Over roads which have been picked out in advance the motor searchlight creeps as close to the trenches as it is possible to go, and trains the searchlight on any position from which an attack is expected or to be feared.

With a 36-in. diameter projector it is common to have an apparatus which can be worked from the rear platform of the car, or which can be wheeled away on its own trucks to some suitable position 200 or 300 yd. from the car. This increases the usefulness, for it is often possible to put the searchlight into a position which could only be reached with difficulty or danger by the complete car. After various types have been tried, the most common plan is to drive the dynamo from the gearset, placed in the center of the chassis above the gearbox, with an inclosed chain transmission.

Two Engines Used

Experiments have been made with the searchlight on a separate pneumatic-tired trailer; in another type there are two engines, the one in front for driving the car and a smaller one in the rear for driving the dynamo only, the searchlight then being in the center. The plan of everything on one chassis and making use of one engine for both the car and the dynamo has proved the most advantageous.

Under the system of trench warfare, motor searchlights get nearer to the enemy than any other kind of vehicle. The internal-combustion motor, however, is advanced still farther, for on some portions of the front portable gasoline-electric groups are carried into the trenches and the searchlight operated from the front-line trench. These are comparatively small outfits, with a face diameter for the searchlight of not more than 10 or 12 in. This work is not exclusively gasoline-electric, many of the armies being equipped with acetylene searchlights for this purpose. In some of the Allies' front-line trenches are to be found Evinrude rowboat engines driving a pump which keeps the trench free from water.

Nearly all armies make use of portable gasoline-electric outfits for illuminating officers' quarters. These consist of a water-cooled engine with direct-coupled dynamo mounted on a wood platform which may be carried by a couple of men. Wiring and lamp sockets are packed separately, and are in charge of an electrician. The entire outfit is brought up on a motor truck, and with the aid of three or four men staff quarters can be illuminated completely in about an hour's time. In a war of movement these gasoline-electric units are of considerable value, for they can be brought up as fast as troops can advance, and within an hour of the order being given any wrecked building which may have been selected as headquarters can be illuminated in the most modern manner.

Stationary Engines Behind Lines

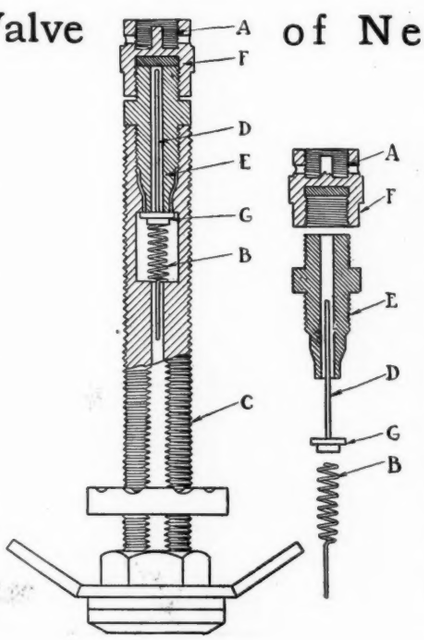
In the constructive work carried out by the engineers only a short distance behind the lines, stationary gasoline engines are extensively used. They are employed for driving stone breakers, mortar mixers, for operating pumps, for circular saws, etc. This refers to advanced work in exposed positions, where the installation must be of a more or less temporary character, and not to permanent positions in the rear, where the use of power-plants is too obvious to need comment.

The gasoline engine plays an important rôle in the postal and telegraph services. Where the rail stops, postal vans pick up the mails and carry them, with no loss of speed, to the troops in the zone of operations, and to such an advanced point that they can be distributed by hand to the men in the trenches. Headquarters' staffs have wireless outfits attached to them, all motor-hauled.

Sladden Tire Valve of New Design

ARRANGEMENTS are being made for the production of a new tire valve which has been invented by Sidney C. Sladden, 233 Broadway, New York. The patent papers have been issued under the date of July 10, and negotiations are under way for the manufacture of the product. It is probable that the valve will be put on the market under the trade name Standard.

The valve operates under a different principle from the common type. Air leakage is prevented by the pressure from within the tube forcing a rubber washer up against the valve opening rather than by the normal conical friction stop gap. The Sladden valve consists simply of the standard exterior with air vent down the middle into which screws a sleeve which holds the valve plunger in position. About halfway down the valve is a chamber into which is fitted the spring. A rubber washer is at the end of the valve plunger. This washer is larger than the air hole of the valve and has a circumference equal to that of the top of the spring chamber. When pressed down as far as the spring chamber it expands to normal size and completely covers the top of the chamber, thus preventing the uprush of air to the top of the valve. The higher the air pressure in the tube the more tightly of course is the rubber washer pressed against the outlet.



When it is desired to release air from the tube a downward pressure on the plunger is all that is needed. Contrary to the usual type of valve-top which has a slotted cap to be used for tightening the conical type of plunger, the Sladden valve-cap contains a short solid plunger which may be inverted and used to press down the plunger, thus releasing the air. The valve head contains a screw thread permitting interchange of the Sladden plunger with the conical type.

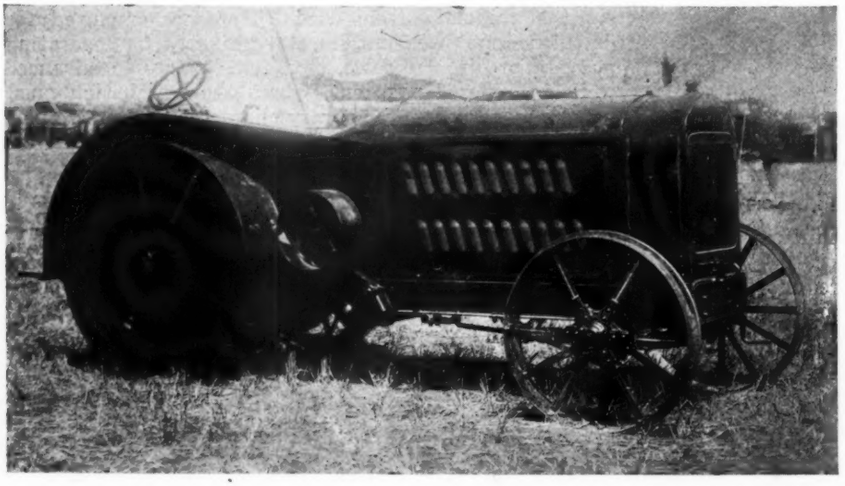
1917 Tractor Development—II

Kerosene Burning More Than Carburetion Problem—No Tractors Burn It Properly—Kerosene Vaporization Must Have Elaborate Heat Control Regulated Automatically — Seek Efficiency First and Simplicity Second

By A. Ludlow Clayden

WITHOUT doubt the ability to burn kerosene is one of the most desired features of a tractor, while it is also one of the rarest characteristics. Of the tractors which claim to be able to use kerosene about 5 per cent will do so with a fair degree of satisfaction, and none will burn it really well, as well as gasoline, that is.

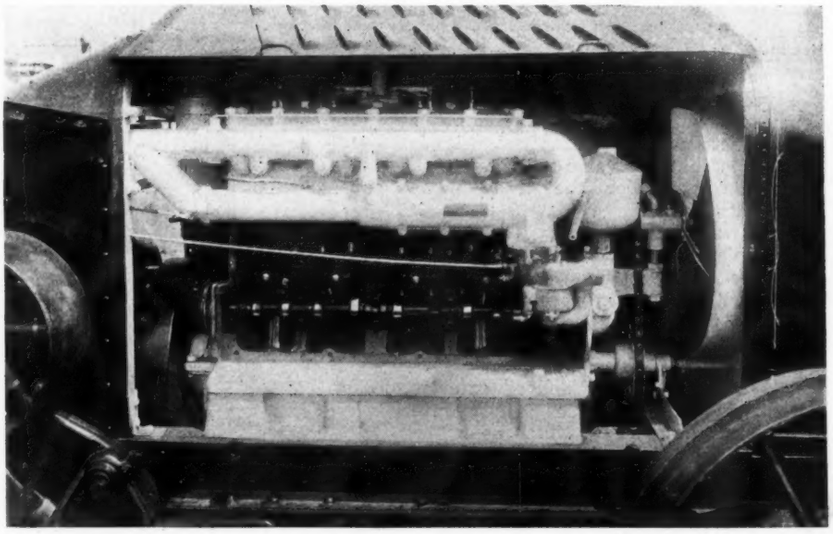
The conditions for effective kerosene usage are set forth very clearly in the paper which W. G. Clark read after the S. A. E. dinner (reprinted on page 331), but the utter truth of Clark's statements is not yet grasped as it should be. In a broad way it may be said that the tractor men have arrived at the realization that kerosene needs something more than a heated carbureter, so we see hot spot manifolds on many machines, heating for both main and auxiliary air and so forth. Despite all this, however, there was not one single tractor at Fremont with a kerosene system which showed full appreciation of the essentials of the problem.



First it is desirable to nail a misconception. There is an idea abroad that a tractor engine need not be flexible; that it is a constant speed engine. This is far from the truth; while nothing like passenger car flexibility is necessary, the tractor engine must idle reasonably well on kerosene and must have a speed variation of at least 100 per cent. That is to say, if its best power speed is 1200 r.p.m., it must be able to pull well at 600 r.p.m. This is mainly because the engine has to pick up its load when running on the belt and it must be able to slow down and accelerate while plowing. Striking a patch of extra heavy going will slow down the plows, and that slowing must not cause the engine to stall.

Less Speed, More Heat

Directly the throttle is closed, or directly the load is increased so as to provoke a slowing down of engine speed, it is necessary that more heat be supplied to a kerosene mixture. In other words the nearer approach that



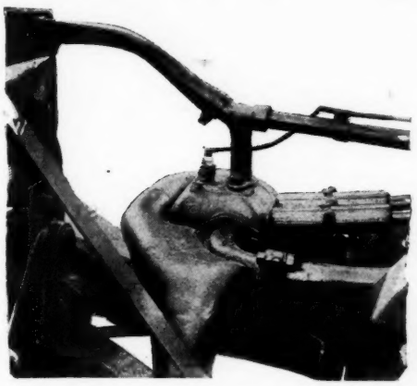
Above—Automobile outline is most strongly emphasized in the four-plow Twin City tractor. This machine has a fully enclosed ring gear

Right—Kerosene engine in the four-plow Twin City tractor. The exhaust heated manifold is shown and also the way in which internal accessibility is obtained by making large sections of the crankshaft detachable. Note the dust collector on the carbureter intake

is made to full throttle and full speed conditions the less the heat required. This, however, is the direct opposite of most exhaust heating systems, where the greatest heat is given to the vaporizer at maximum speed and load. Suppose that we adjust a vaporizer so that the engine is performing as well as possible at maximum speed and load, then there will be far too little heat at lower speeds. If we adjust for lower speeds, then there will be too much heat at high speeds.

For the manufacture of each cubic foot of kerosene explosible mixture so much heat is needed. More will cause the internal burning of the mixture, less will permit the condensation of drops of raw fuel which will not burn.

This sounds as if a constant vaporizer temperature was wanted, but the case is more complicated than this, because closing the throttle causes a drop of temperature in the manifold due to the expansion of the wire-drawn gas. If the speed of an engine varies owing to load alone, the throttle being open fully all the time, a certain constant amount of heat per cubic foot of air inspired is needed. If, on the other hand, the speed is varied at constant load, by opening or closing the throttle, then the amount of heat required per cubic foot of air inspired is quite different. What we need to keep constant is not the temperature in the vaporizer but the temperature in the manifold.



Exhaust manifold brought round Allis-Chalmers cylinder to make intake hot spot for using kerosene on horizontal engine

Effect of Water

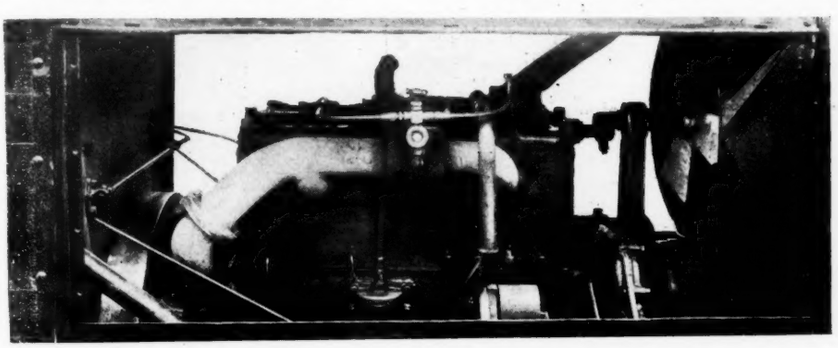
On most of the kerosene outfits which perform reasonably well water is injected or added in some way to the gas. The effect of this is usually to cool down an overheated mixture, so that it is possible to adjust the heat supply to suit half speed running and not have too much at full speed, because the water will absorb the excess in being boiled. Otherwise the water has no effect, beneficial or otherwise. Mr. Clark stated very positively that years of experiment had failed to show that water additions had any effect on the deposition of carbon. The addition of water is a palliative merely. It is tantamount to a confession that the system of kerosene vaporization is imperfect, for it is merely waste of fuel energy to turn a small quantity of water into steam which afterward condenses in the exhaust. It is to prevent overheating at full load that water is required, and using water is the equivalent of taking a dose of a strong drug mixed with a dose of the antidote.

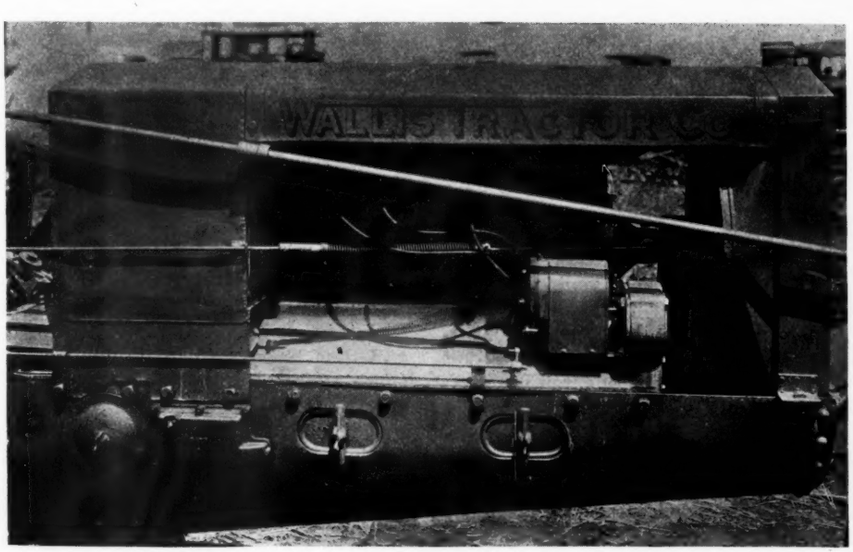
The hot bulb engine, erroneously called the semi-Diesel, fills the cylinder each stroke with pure air. Into this charge, after compression, is injected a jet of kerosene which burns in the air. It uses either a whole or a part of the oxygen contained in the air, according to the amount of fuel injected. The trouble with it so far has been that it is difficult to control the amount of fuel injected with sufficient delicacy. In other words, we lack the means for controlling minute quantities of fuel to be consumed in an excess of air at constant compression.

The alternative is to try to make a combustible gas of kerosene and air which will be a "fixed" gas at least for the time elapsing between formation and combustion. Far more effort has been expended in this direction than in trying to overcome the purely mechanical difficulties of controllable injection of liquid to the cylinder.

The Nearest Approach

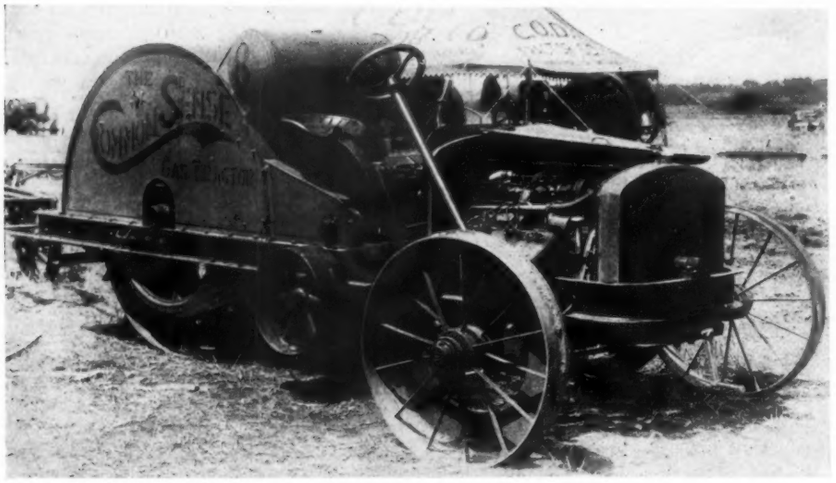
The nearest which seems to have been approached to a proper principle





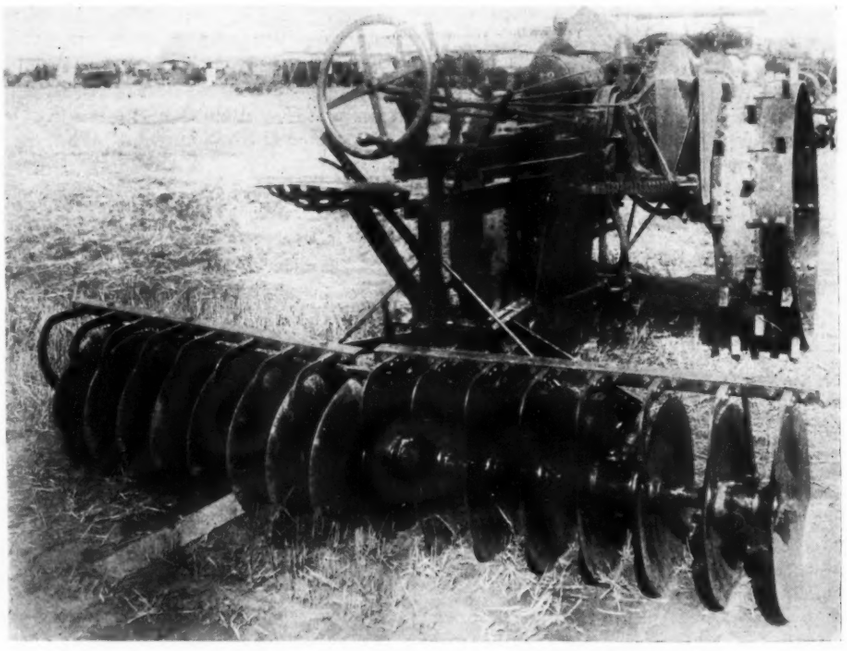
Above—Engine of the new Velie tractor. The box on the exhaust manifold is a small boiler. Water is fed to it through a drip and steam under slight pressure is discharged to the intake side of the carbureter for running on kerosene

Left—This view shows how the Wallis power plant sets in the frame, the latter forming the transmission case and also the oil pan for the engine. There is no side piece to the hood since the enclosure provided for each detail part is adequate. The hand holes on the side of the frame give access to the oil pan, clutch, etc.



Left—One of the few drum drive machines, the Common Sense. This has an eight cylinder Herschell Spillman automobile engine

Below—This rear view of the Moline universal shows the way in which the implement is made integral with the tractor, all the controls for the latter being brought back to a convenient position to the operator. A great variety of implements can be attached in a similar manner to the same tractor. Partly owing to this fact the Moline has been doing particularly useful work on minimum-sized farms



of kerosene carburetion is to make a rich hot gas mixture, and to dilute it with air somewhat less strongly heated. The effect of this is that when the extra air valve is closed, as it would be when the throttle was closed, the hot mixture is used practically raw; but that as the air valve opens the temperature of the initial mixture is reduced. However, none of the equipment shown on the Fremont tractors had any pretense at an automatic control of temperature, nor of a control which varied in any way with the initial temperature of the atmosphere. Seeing that the atmosphere can easily vary 100 deg. Fahr., this appears to be absurd.

Let it be remembered that there is more than plowing to be considered. Belt work can be carried on in the coldest weather, or if we omit that, there is no doubt that the farmer will want to work at any air temperature from 35 to 105 deg. both on the belt and in the field, and a carburetion system which entirely neglects this fact is only half a system.

Proper kerosene vaporization will be obtained by the use of thermostatic control and probably by no other means. It is recognized that to get proper performance from a gasoline automobile some control on the cooling system is essential to prevent the cylinders and manifold from getting too cool. With kerosene we have the same thing immensely intensified. While gasoline, even as it is to-day, will form a mixture over a fairly wide range of temperature, kerosene will only do so over a very narrow range. To get proper kerosene burning we must have that narrow range maintained absolutely, and it can only be so maintained with the devices known to-day by using a thermostat which responds to the temperature of the gas mixture in the manifold.

The simplest tractor is the one which gives least trouble, and the complication of an elaborate automatic kerosene control system would be a simplification if it involved better operation. On a warm August day at Fremont 90 per cent of the tractors burning kerosene were sending out clouds of acrid blue smoke, showing beyond all dispute that the combustion was only partial; on a cold day such machines would not run on kerosene at all. An impure exhaust is sure indication of trouble to come from deposits in the cylinders and vitiation of the oil. It is time that our engineers had courage to put on something really complicated for kerosene burning. If the complicated device which really does the work comes first, the simplification will follow, but if inefficiency is tolerated for the sake of simplicity there is nothing to lead toward better performance.

The best kerosene system with which the writer has had any personal experience had no less than three hand controls. Each of the three had to be altered for each change in speed and load, but the results were nearly perfect. This was some years ago, and the thermostat would have done the work of two of the controls had it been known at that time. As it was the development ended with the war.

Impulse on looking at an elaborate kerosene system which takes everything into account is to think that something simpler must be available, and then to experiment minus two or three of the parts. This is the wrong way to work. Never mind how complicated the thing is to start with, let the laboratory engineer be sure he has a control for every condition and the simplification will follow in due course of time.

Kerosene Needs Special Engine*

Vaporizer Alone Cannot Handle Kerosene in Gasoline Motor—Good Results with Engine and Vaporizer Designed for Each Other

By W. G. Clarke
Chief Engineer, Wilcox-Carburetor Company

THE use of low grade fuels for tractor and truck motors has been for some time the subject of considerable debate and experiment. Of the mass of data now available on the subject there is much that is conflicting and erroneous, but enough careful work has been done so that certain fundamental principles, essential to efficient and satisfactory use of low grade fuels have been established and are more or less common knowledge. These essential principles and requirements are well defined and have been put before engineers and manufacturers many times, but it is a regrettable fact, that the short-sightedness of the majority of motor manufacturers and their reluctance to effect changes in design, which are so necessary in handling low grade fuels, have been chiefly responsible for the failure of most of the so-called kerosene tractors and have given kerosene and other low grade fuels their present ill reputation.

The object of this paper is to again set before the most interested what has been done and what must be done to make all our tractors successful in operating on low grade fuels; and in this way to further the work of co-operation and standardization so vitally necessary in the tractor industry to-day.

What Experiments Show

The treatment of all low grade fuels is essentially the same but I wish to deal more specifically with kerosene, as it seems to offer the most logical solution of the present fuel problem.

All experiments with kerosene show conclusively that heat must be applied to assist in vaporizing the fuel, particularly for multiple cylinder motors so that the first step in the solution of the problem lies in the determination of the best method of applying the head. There are four principal methods now in common use, i. e.,

1. Applying heat directly to liquid fuel before it leaves the nozzles which will give maximum power and fair economy within limits, but lacks flexibility.

2. Exhaust jacketing of the intake manifold which heats the whole mixture. This entails a high volumetric loss but gives good economy and flexibility.

3. Preheating the air before it enters the carburetor, which produces a high volumetric loss and poor economy. This method does not apply the heat at the right time or in sufficient quantity with the result that a large part of the fuel either goes out the exhaust or into the crank case.

4. A compromise of the two extremes, effected by exhaust jacketing a part of the carburetor above the bowl. In this method the fuel charge is heated to a high temperature with a small portion of the air, and after passing through the heat chamber is diluted and mixed with cold auxiliary air. This produces a mixture with all the advantages to a slightly modified degree of the other methods, with none of the disadvantages.

There are numerous combinations and modifications of the above methods of applying heat but they all can be classified under one of the four heads.

With the hope that perhaps it will save others unnecessary work, I will outline briefly a few of our own experiments in determining the best method of obtaining proper low grade fuel mixtures.

Our first attempts to burn kerosene were made in 1911 on a 6½ x 8 4 cylinder, L-head motor. We first used an exhaust heated box containing a coil of pipe. This pipe was connected to a carburetor and to the engine manifold. The kerosene was drawn through the pipe coil with a small quantity of air and heated to a high temperature by the surrounding exhaust. After passing into the manifold the hot rich mixture was diluted and cooled with cold air and water vapor drawn from a second carburetor connected to the manifold beyond the heater. With this apparatus we lost too much power and had great trouble with pre-ignition and formation of carbon in the heater.

We then tried forcing the mixture through with a portion of the exhaust to reduce resistance in the heater and to increase the temperature, but we still lost power and the pre-ignition was worse than ever. The pistons were then given more clearance and a stream of cold water turned on to the spark plugs which were in the valve caps, and the pre-ignition was materially reduced. Although the temperature got as high as 900 deg. Fahr. we did not crack the fuel. We proved this by interposing a radiator as a condenser between the heater and the manifold and were then able to condense the fuel back to raw kerosene. This apparatus was described in a paper presented by Mr. Bennett before the Metropolitan Section of the S. A. E. in March, 1913, and appears in the bulletin of that date.

The second apparatus was a slight modification of the first and was used on the silver medal winner of the Winnipeg Tractor Contest of 1911. It gave good economy and flexibility but lacked power and was quite cumbersome.

Fuel-Injection Methods

Fuel injection methods were next tried but were found to be too delicate on account of the small quantities of fuel used. Mechanical difficulties also involved so many complications that this method was abandoned as impracticable.

We also tried heating the air in an ordinary gasoline carburetor but again lost too much power and encountered more pre-ignition and distribution trouble.

The next logical step was to heat the fuel, which we accomplished by exhaust jacketing the fuel bowl.

By deflecting a portion of the exhaust gases through this double bowl we could maintain the temperature of the liquid fuel at nearly the boiling point. To atomize the fuel we used a multiple jet standpipe with about seventy-five jets, which broke up the liquid into very fine particles. This gave a decided gain in horsepower although the economy was practically the same as with the first heater at full load. The light load economy and the flexibility was not so good.

We next worked to get better economy and flexibility by making various devices to break the fuel up finer. Some very successful ones were tried which bettered the economy greatly at full load but they proved to us that light load economy and flexibility are dependent on high temperatures unless excessive gas velocities are maintained. But to maintain a high gas velocity at low speed means wire drawing and volumetric loss at high speed so we abandoned our mechanical vaporizers and went back to the heat problem.

These experiments had shown that we must use high temperatures for light loads and low speeds, and as little heat as possible at heavy loads and high speeds depending on velocity to prevent condensation at the higher speeds.

After numerous experiments with jacketed manifolds and

*Paper read at Fremont S. A. E. tractor meeting, Aug. 8.

various combinations of heated air and heated fuel, we evolved our present type of carburetor which is a compromise, embodying as far as possible the best features of our other designs and which will give the maximum of power consistent with flexibility and economy. In this carburetor we utilize the whole exhaust of the motor passing it around a heat chamber through which is carried the fuel with a small portion of air. The high temperature to which this primary mixture is subjected is lowered beyond the heat chamber by the admission of cold auxiliary air. To obtain the higher temperature necessary at light loads we employ a weighted valve in the carburetor controlled by the motor suction, which admits hot primary air at light loads, raising the mixture temperature when the exhaust gases contain the least heat. This valve closes under the increased suction of heavy loads and admits cold air to the heat chamber with the fuel, which together with the final dilution of the rich mixture with cold auxiliary air helps to offset the increased and unnecessary temperature of the exhaust at heavy loads. With this scheme we obtain the best heat conditions for kerosene, namely: hot air, hot mixture at light load, cold air, cooler mixture and high velocity at heavy load. Additional cooling is provided for by the admission of water when necessary by means of the same valve that regulates the primary air temperature, so that the entire heat control is practically automatic.

Kerosene Tractor Equipment

The foregoing deals merely with obtaining the mixture through the proper application of heat. We had innumerable difficulties with gas distribution, manifold condensation, pistons, spark plugs, etc., of which I wish particularly to speak to show that the kerosene carburetor does not exist so much by itself. The kerosene tractor, however, must include:

1. An efficient vaporizing device to produce a homogeneous combustible mixture.
2. A properly designed manifold to carry the mixture to the cylinders without condensation and with uniform distribution.
3. A motor so designed as to take care of the higher operating temperatures of kerosene and capable of burning a kerosene charge efficiently.

The first two requisites have been more fully developed than the third and until the motor manufacturers and the accessory men get together and co-operate in producing a real kerosene motor, the kerosene tractor will remain as it is now, a makeshift at the best. There is no gainsaying the fact that the majority of so-called kerosene tractors are failures; and that the best of them are far from being as efficient and easy to operate as they should be.

Gasoline equipment will not handle kerosene satisfactorily nor will the installation of a kerosene device make a kerosene motor out of a gasoline motor, notwithstanding popular belief to the contrary.

The failure of the motor engineers and the carburetor men to get together in the past and co-operate in getting the best results in handling low grade fuels is due to several things, chiefly:

1. The reluctance of most of the motor manufacturers to accept the results of outside experiments as affecting motor design.
2. The high cost, lack of adequate facilities and time required for effective experimental work.
3. Stress of increased production demands, precluding radical changes.

The result has been that the carburetor men have assumed the whole burden and have been expected to produce an instrument which would make a kerosene burning motor out of the existing types of gasoline motor.

All of the kerosene tractors now on the market can be roughly divided into two classes; those that have made efforts to adapt their motor for kerosene work, and those that have simply attached one of the numerous kerosene devices. The latter class is by far the majority and it is largely to their failure as efficient kerosene tractors that is due the poor opinion of kerosene as a fuel. To illustrate how this class of machine will fall down, take the experience of a service man who was delivering a new tractor. It was one of those equipped with a heated air carburetor for kerosene and as is usually the case when these machines are running light, the mixture had to be kept pretty rich to keep the motor going. After traveling a few miles from town the lubricating oil got so diluted by raw kerosene working past the pistons, that two bearings burned out before the operator was aware of it, and this was on a new machine that had not even reached its point of delivery.

Clearance and Cooling of Piston

One of the first and most important things to consider in kerosene motor design is the clearance and cooling of the pistons. Due to the higher operating temperatures in kerosene work, the expansion and heating of the pistons is much greater than with gasoline, so that the clearance between the cylinder walls and the pistons must be greater to prevent seizing and scoring. Experiments with various types and sizes of pistons have shown that the body clearance should range from one, to one and a half thousandths per inch of diameter. The rest of the piston should be tapered towards the head with a clearance of four or five thousandths per inch of diameter at the extreme top. This is considerably more than automobile practice but the tractor piston is subjected to high and sustained temperatures which the automobile piston never gets, and if clearances are not sufficient to take care of the additional expansion the pistons will seize and score the cylinder or at least cause heavy pre-ignition.

Piston heads should be thick and well ribbed and filleted to carry the heat away from the center of the head to the piston body when it can be transmitted to the water jacketed cylinder walls. If this is not done the center of a piston will frequently get red hot and cause pre-ignition.

Ring gaps should also be slightly greater in the kerosene motor to allow for expansion. Water jackets must be extra large and unobstructed and should be carried a trifle lower than is customary in gasoline designs so as to afford a free and uniform circulation of the cooling water and to help carry heat away from the body of the piston.

Valve seats, especially exhaust valve seats, should be well water jacketed, because a hot valve or valve cap will cause a lot of pre-ignition trouble that is very hard to locate.

The form of the combustion chamber, efficient cooling of the valves, together with the fact that the intake passages have so few turns and pockets are what makes the valve in the head motor so well adapted to low grade fuels.

The compression is usually somewhat lower in kerosene work although it is difficult to give any fixed rule for determining it. We have found that the best results are obtained by lowering the compression as far as possible without sacrificing power. In some motors it is possible to drop the compression 20 or 30 pounds without losing in maximum power although naturally the fuel economy and efficiency will not be so good. For good all around work the compression rarely exceeds 65 lb. although it can sometimes be carried higher in an exceptionally well-cooled motor.

Type of Spark Plugs Important

The type and location of spark plugs is a very important factor in kerosene work as the spark plug is one of the commonest sources of pre-ignition. A plug with a heavy metal body and heavy wire electrodes, presents a large heating surface to the burning charge and often becomes red hot, causing excessive pre-ignition.

The plug should preferably be located in the center of the cylinder head in a well-waterjacketed position, so as to be cooled as much as possible. A spark plug placed in a valve cap, especially over a hot exhaust valve, cannot be cooled and will burn up and cause pre-ignition with kerosene fuel.

Cylinder combustion chambers must be smooth since rough spots or small metal projections soon become glowing points.

There is still much to be done towards perfecting the design of manifolds for low grade fuels.

In multiple cylinder motors the problem of distribution without condensation of the fuel is just as important and probably more difficult than the production of a vaporized charge. Experiments have shown that kerosene mixtures will condense in the manifold at temperatures below 350 deg. Fahr. unless the gas velocity is kept very high. For this reason the best results are obtained by making the manifolds

as small as possible without causing a power loss and wire drawing. This is feasible with the tractor motor because it is still essentially a slow speed motor. We experimented with a manifold composed of a bundle of small copper tubes soldered together having in it a sliding throttle which controlled the number of tubes in operation. By this means we were enabled to maintain a practically constant velocity at all speeds which meant that by carrying an initially high velocity we could maintain a dry mixture with the minimum of heat.

Baffles Reduce Condensation Troubles

In some of our earlier kerosene experiments, excessive manifold condensation gave us a great deal of trouble. We found that by placing dams or baffles in the manifold that this trouble could be greatly reduced as the fuel in breaking over the sharp edges of the baffles was pulverized into very fine particles instead of going through in large globules.

I do not believe that a manifold should pass through the water jacket if kerosene is to be used as a fuel. The temperature of the water jacket is lower than the mixture temperature at light loads which will cause condensation and loading, although at full load it would not make so much difference.

In general a small manifold designed for uniform distribution and as short as possible will give the best results. It is hardly necessary to dwell on the fact that the fewer turns in the manifolds and pockets in the valves chambers and cylinders, the better distribution and operation will be obtained.

The present design of opposed motors with their long exposed manifolds offer the greatest difficulties in distribution of heated mixtures. However, these difficulties can probably be largely overcome by exhaust jacketing or insulation or by retarding the intake valve opening to obtain a high vacuum.

There are several designs of double or exhaust jacketed manifolds now in use for multiple cylinder motors which are all more or less subject to criticism. In most of them only the upper wall of the intake manifold is in contact with the exhaust. This construction produces a condition in the mixture which is diametrically opposite to that desired. The lighter and therefore more thoroughly broken up particles of fuel are the ones which impinge directly on the upper hot surface while the heavier unvaporized globules of fuel follow the lower and less heated wall, especially at low velocities which does not make for a homogeneous mixture and which is quite likely to produce carbon through cracking.

Another form of the exhaust heated manifold which does not distribute the heat uniformly is of the type that allows the exhaust to escape from one end only. This means that those parts of the intake nearest the exit receive more heat than other parts farther away.

Preignition Difficulties

In spite of careful precautions against preignition we invariably encounter it in high temperature work unless the compression is so low that efficiency is greatly decreased. A well designed motor will deliver a little more than three-quarters of its maximum power without pre-ignition, so that it should not be necessary to use water in the mixture much below that point. The primary object in using water is to cool the mixture before it enters the cylinders, so as to keep the volumetric efficiency as high as possible and to stop preignition. In some types of engines the amount of water necessary is quite high, varying from 20 to 50 per cent, but if properly used in a well designed motor, from 6 to 12 per cent should be amply sufficient.

In order to use as little water as possible it should be introduced in a finely atomized condition so as to present the greatest cooling surface with the least volume. The necessity of using a minimum of water is apparent when you remember that in vaporizing, the water extracts its heat from the fuel, so that for every ounce of water it takes about 5 per cent of the same amount of kerosene to vaporize it. This fact is quite often disregarded and water is allowed to slug into the mixture in excess quantities producing poor economy, missing and loss of flexibility. Since water in a finely pulverized state will absorb a large amount of heat, it serves as a very simple and effective means of lowering the mixture temperature and preventing pre-ignition.

We have never been able to find any evidence that water had any appreciable effect either in the formation or removal of carbon.

There is still another factor to be considered in putting out a kerosene tractor, and that is a consideration of the ability and knowledge of the men who are to handle them in the field. It must be admitted that the very best of our kerosene tractors are not quite as easy for the average farmer to operate as the gasoline tractor; so that to insure the success of kerosene as a fuel we must go beyond the mere manufacture and marketing of the machine, and must get together to instruct and enlighten the owners and operators in the handling of low grade fuels.

A good kerosene tractor in the hands of a poor operator will behave just a little bit worse than a gasoline machine with the same operator, so that it is our duty to first make our products as near right as possible, and second, to give the farmer the benefit of our experience in using them. It is only in this way that we can hope to make the kerosene tractor the success it must become.

Educating Through Trade Papers

The trade papers are doing a great work along educational lines, but some of them have fallen down in one respect, and that is, in their evident failure to investigate the reliability and truth of their advertising. This has resulted in the publication of a great deal of misleading information especially concerning so-called kerosene burning devices, some of which cannot possibly do what the advertisers claim for them.

The worst offenders in this class are those advertisers of kerosene attachments which guarantee to make a perfect kerosene engine out of any make or type of gasoline engine which is obviously a misrepresentation of fact.

It is the advertising and sale of such products which cannot be successful that has done so much damage to the reputation of kerosene tractors and to kerosene as a fuel. At this time it is a patriotic duty of every advertiser and advertising publisher to make sure that he is not misleading the tractor-buying public, and the trade papers with a little care can do much to eliminate this evil.

The thermodynamics and fundamental principles of carburetion have been presented and discussed many times by able men, so I have purposely refrained from a repetition of well-known facts as far as possible. Instead I have tried to put the kerosene tractor situation before you in such a way that you, the members of the S. A. E., will endeavor more earnestly through your organization to effect the union and co-operation of the motor manufacturers, the tractor men, the accessory men and the trade papers; and by so doing, hasten the development of what is now one of our greatest economic necessities, the Standardized American Kerosene Tractor.

Canada Increases Car Purchases

NO better indication of Western Canadian prosperity can be imagined than the statistics from the License Departments of the Provinces of Manitoba, Saskatchewan, and Alberta which show a total registration of 59,785 cars, an increase of 25,273, or 73 per cent, over 1916.

Manitoba has a total of 15,975 cars, against 11,352 in 1916, and 9250 in 1915. There are 15,201 cars owned by private parties, the remainder being owned by dealers and the trade. Chauffeurs number 1323.

Saskatchewan has a total of 27,352, an increase of 13,503 over 1916, and comparing with 9197 in 1915.

Alberta shows a total of 16,458, compared with 9211 in 1916, and 5835 in 1915. Residents of Alberta have invested about $15,000,000 in cars.

The eastern part of Canada also shows a large increase. The Province of Quebec licensed 1112 cars up to June 1, as against 1064 for the whole of 1916. In 1915 it had 10,112 cars, which jumped to 15,335 cars the next year. It is expected that there will be 20,000 by the end of 1917. The four-cylinder car was the most popular in 1916, there being 13,854 of them, as against 1121 sixes, ninety-three eights, and twenty-four twelves.

Must Charge for Tractor Service*

Service Will Always Be Necessary and Will Cost Least If Well Organized—Standards Like S. A. E. Possess Great Factor for Economy

By George T. Strite
Consulting Engineer, Minneapolis

UNDER the present system every tractor manufacturer must add to the selling price a certain amount for service; a certain amount which he must practically lay aside to spend in service to tractor owners. Each farmer who buys a tractor pays for this service when he buys his tractor. Seventy-five per cent do not use this amount of service, while the other 25 per cent use enough more to make up for the other 75 per cent. If this could be equally distributed it would be fair and just; but it is not.

I know of one case where four tractors were sold and shipped practically at the same time, all being alike. The amount of service furnished to each of the four owners, A B, C and D, after one year's time, was found to be as follows: A had used about $10 worth of service, B $5, C $15; D had been continually in trouble. The company had sent man after man, and had spent more than $170. The company at that time figured to spend on an average of $50 per machine in service. In this case D had used nearly all of the service which A, B and C had paid for. The tractor that D owned was sold to another farmer who repaired it at his own expense, and nearly broke all records. This is only one case in hundreds.

Now, if these tractors had been sold for $50 less to each farmer, farmer D would never have asked for this amount of service. There are engine and tractor experts in almost every small town who can, if the farmer will call on them, do the required expert work for from one-fifth to one-tenth the actual cost to the manufacturer, if the manufacturer is required to send a man from the factory.

Educational Work

It would seem to me that the S. A. E. should have a tractor service committee and an instruction book could be published and sold. This committee could have a board of examiners, and possibly issue S. A. E. service buttons, or something of the kind, to service men who could intelligently answer a set of questions. A complete record of capable service men should be kept by this committee which should be of considerable value, especially so if the government should decide to take up the tractor service proposition, thus requiring a large number of service men.

Quick, reliable repair service is one of the most important subjects in the tractor game. This is one reason the Ford car is so popular; any repair for a Ford car can be obtained anywhere at any time and at a low price. The best way to facilitate the matter of tractor repairs is through the standardization of parts. A great many parts can be made and tractors can be slightly changed, so that these parts will fit many different makes of tractors.

S. A. E. Standards

Many tractor companies and many of the S. A. E. engineers have laughed at the idea of standardizing tractor parts. It is going to be a big job, and is going to require an immense amount of work, but we are going to do it, and I firmly believe that we are going to carry the standardization work in tractors far beyond what the Society has been able to do in the automobile. The standardization work in the automobile has been carried much farther than any other manufactured machine in the world, but why should not we go even farther? We have all the advantages of what the S. A. E. has learned in standardizing the automobile and truck parts. When the society started it did not have the prestige and power that it has to-day.

No one man, or no one corporation, in the world has power or prestige enough to bring about these standards. There is only one organization in the world big enough, with prestige enough, and the ability to bring about these standards. This organization is represented by three letters, the most important letters in the alphabet—S. A. E. We are proud of not only the prestige, but the straightforward, honorable reputation and achievements that these letters represent. It will not be long before advertisements will emphasize the fact of the number of S. A. E. standard parts used in tractors. We will see at every country town and village on the sign above some door, "S. A. E. Tractor Parts Sold Here."

When this is done it will not be long before nearly all manufacturers will get in line; they will get in line because they cannot afford to do otherwise. They will get in line because every purchaser will ask the question: How many S. A. E. standard parts are in your tractor? Everything else being equal, the purchaser will buy the machine which has the largest number of standardized parts, which he knows he can get almost anywhere at any time, and of a recognized quality.

One of the great benefits of the standardization of parts is the fact that, by so doing, the manufacturer can manufacture more cheaply, the farmer can buy more cheaply, the distributors and dealers can carry repair stocks to accommodate all machines with from 10 to 20 per cent of the actual investment which would be necessary without standardization.

Recommendations Committee

In the Minneapolis section of the S. A. E. we have a committee which now is called the Recommendations Committee. This was formed for the purpose of aiding the Tractor Standards Division. Many of our engineers are designing new machines and redesigning old machines, and they were continually pressing us for information. Therefore, it was decided to get up data sheets, not of standards, but of recommendations to S. A. E. engineers. I believe this is going to be of very great value, as it will help to get the engineers working with certain sizes, and we will begin to get uniform sizes, so that the Tractor Standards Division of the parent society can take up these sizes and dimensions, and make the proper standards.

Connecting-Rods

One of the subjects taken up by this committee is connecting-rod bearings. It was found that the crankshafts in the four-cylinder tractor engine vary in diameter from 1⅞ to 2¾ in. The committee has practically decided, if agreeable to the manufacturers, to recommend to the engineers that, in designing or redesigning engines, one of the following sized bearings be adopted:

Diameter	2	2	2	2¼	2¼	2¼	2¼	2½	2½	2½	2½
Length.	2¼	2½	2¾	2½	2¾	3	3¼	2¾	3	3¼	3½

This will mean fourteen bearings; probably eight or ten of these will eventually be the popular sizes. The engineer can choose a light, a medium, or a heavy bearing from the above bearings on almost any size engine he may choose to build. The sizes of crankshafts and bearings now run are 1/16 and

*Papers read before tractor meeting of the Society of Automotive Engineers at Fremont, Neb., Aug. 9.

⅛ in. These the committee wishes to cut out and jump by ¼ in. only, in both diameter and length of bearing. The radius of the fillet can be the same in all bearings. The distance from the end of the bearing to the side of the connecting-rod can be the same in all bearings. The thickness of bearing metal can be the same in the 2 and 2¼ in.; it will probably be 1/16 in. thicker in the 2½ and 2¼ in. This will give a uniform diameter for the bore in connecting-rods. I firmly believe that we can cut out the odd sizes in connecting-rods and have probably three or four different lengths.

Sizes of Tractors

The committee has had many discussions in regard to the sizes of tractor engines. In the small tractor of to-day, four-plow and less, we have five sizes, as follows:

Rating, Horsepower	No. of Plows	Pounds, Drawbar Pull
8-16	2	1,200 to 1,500
10-20	2 to 3	1,500 to 2,000
12-25	3	1,800 to 2,400
15-30	3 to 4	2,200 to 2,800
20-40	4	2,500 to 3,500

There are to-day in the United States probably between twenty-five and fifty different sizes of tractor engines. It seems to the committee that this can eventually be cut down to something on the lines of the above sizes.

Tractor Wheels

The Recommendations Committee has spent a great deal of time on the subject of tractor wheels. There are now a great many different sizes. The committee has gone into the matter very carefully, and has practically decided to recommend the following: Diameter, 48, 54 and 60 in.; widths of drive-wheel, 10, 12, 14 and 16 in.; thickness of rims, ⅜, 7/16 and ½ in. On account of the tendency at the present time to do away with the exposed bull gear in the drive-wheel and use an internal inclosed gear, or direct drive through the axle, it was decided not advisable to make any recommendations as to the size or style of spokes, hub or bore of hub of the drive-wheel at this time. This committee has a table of recommendations also for front wheels.

The great object of the above recommendations, and of the work of the Standards Committee, is not to design parts, but to decrease the dimensions of parts, cutting out the middle and odd sizes, to bring all parts down to the lowest possible number of sizes, and still be able to fit all the different loads and conditions—as, for instance, the above connecting-rod bearings. Such standardization will enable manufacturers to manufacture bearings at much less cost than they can now be made.

It would seem to me that the Standards Committee should give, for instance, to each bearing a certain number, or a certain code word, whereby there could be no mistake in filling orders. This is very important. There should also be some system by which the quality of material could be designated in, for instance, S. A. E. bearings. The manufacturer should be compelled to stamp his name, or trademark, on each bearing. We must have standard uniformity of material, as well as standard sizes. We must be sure that the Tractor Division of the S. A. E. will do nothing to destroy, but do everything possible to preserve the present honor and dignity of our name; through the standards work we will have our name above the door of tens of thousands of the best and most responsible distributors, dealers and service houses, we hope, all over the world.

Dealers Should Train Tractormen

By E. L. Woods

Manager Tractor Sales, J. I. Case Plow Works, Racine, Wis.

TO be of service to a tractor owner does not mean that the manufacturer or dealer must donate repairs or mechanics' time that is a direct outlay of money. That is not service. That is equal to a cut in price. If one man buys a tractor, and, owing to his limited knowledge of machines, he has to call on the manufacturer or dealer for help, and a man is sent several hundred miles to do several days' work for him free, it is equivalent to giving that man the $100 or $200 that the trip and repairs cost. It would have been just the same had we given him a rebate when he purchased.

Smith, his neighbor, who bought the same machine, and paid the same price, was capable of operating the machine, and did not have to call for assistance; therefore, we did not spend money on him, and Smith did not get as good a deal eventually as his neighbor.

If the manufacturer is adding enough to his price to send mechanics over the country on call, furnish gratis repairs, and, in some cases, pay the farmer for lost time, as is many times claimed, he should make this addition to his price a discount to a man who does not have to demand it. On the other hand, if the manufacturer is not adding this to his price, and keeps doing it, that manufacturer will be one of the missing members at the demonstration of 1920.

Service—a useful office—is much needed in the tractor business to-day. It should start in selling the contract to the dealer. The sales representative should canvass the matter of service in making contracts so that the dealer will have a clear understanding of what he is undertaking to sell. A salesman should, if anything, wave the flag of caution plainly at that time, so that the dealer will not over-sell one of the tractors that he is then buying.

If the dealer was selling a horse he would not stand and shout by the hour that this 1500-lb. horse could pull a certain amount. He would sell the horse on its general good points, and let the buyer figure out its usefulness. There is nothing more complicated about selling tractors than there is about selling horses if we maintain the reasonable selling arguments.

The dealer and the traveler should keep away from such statements as number of plows, capacity, inches deep, size of grain separator, etc., in positive statements. It is all right to maintain that, should the conditions be favorable, the tractor will pull a certain size of machine, or a certain number of plows, but the tangible facts should be that this machine will develop so many pounds at the drawbar, or so much power at the belt, and then, as in buying a horse, the farmer can utilize that power as he may see fit, either pulling one plow 12 in. or three plows 4 in. deep.

If the dealer is well coached in this line of talk he will not get into trouble, but if, on the other hand, he is made to believe that the machine we have just contracted with him for will do anything, he is going to have promises lined up for those tractors before they arrive that will make the manufacturer cut the price several times before he ships the second tractor to that dealer. He will have to do it by sending men there to fix the tractor after it has done these impossible things, or to talk the dealer's customer out of wanting the machine to do these impossible things.

Every Detail Should Be Explained

The next necessary step of tractor service is to acquaint the farmer that he is not purchasing Liberty Bonds that will just pay a dividend without any worry or taxation, but that he has purchased a power plant that is worthless, and worse than worthless—like a compound interest note unpaid—unless it has an operator. The new owner should be carefully acquainted with every detail of the machine he has purchased, and with the items of expense for repairs if it does not have the right attention. All this should be emphasized so earnestly that in running that tractor home he will not run over 1½ m.p.h. if its possible speed is 2½ or 3, or in plowing the first acres he will plow five acres a day if it will comfortably plow ten, that, in starting out, he will be so intent on listening to the engine that he will stop every mile and look it over for fear it might run out of oil and break something.

If we can get the owner in that frame of mind we need not worry that he will have any serious trouble, for by the time he gets comfortably acquainted with his new purchase he will notice in a moment if there is a new noise in the engine, or if something is loose, and will fix it before it gets worse. If he is so constituted that he can acquire this he will become so worn out that he will hire a driver or sell the tractor. There are a number of fellows that are tractor purchasers, have been tractor purchasers, or are going to purchase in the future, that will never know how to operate them. We know of men that cannot drive a horse, cannot work horses without killing them, or killing themselves, and could never be taught to, no matter how hard they tried to learn.

Competent Operators Essential

I know men that were raised as farmer boys who caused their fathers so much expense each year on account of their carelessness or inability to handle horses, their breaking tools, leaving gates open, etc., that they could not afford to keep them on the farm, and yet those same boys are at the head of professions to which they have turned their attention, and are successful men. I say, therefore, that all tractor owners are not going to be successful tractor operators. For the good of the industry, when we find one of these fellows, let us work some way to get our tractors out of his hands, or get him to hire a successful operator. If we get the machine out of his hands let us warn our competitors so they will not sell him another unless he gets an operator. His business will not be worth the price that it will cost us finally in that locality.

The manufacturers and dealers should keep tractor operators in mind, and in a case such as has been referred to should be able to furnish an operator that would be successful, and, by so doing, turn this dissatisfied owner into a tractor booster.

Dealers should always be on the lookout for young men mechanically inclined that would make good operators, and do everything possible to train them so they can be recommended as "tractorneers." There is going to be a call for "tractorneers," and they are not going to have to work cheaply either; but they must be capable of operating machines efficiently. By efficiency we mean constant, dependable work for 9 hr. out of every 10 hr. called for. If a farmer will pay a man $30 to $40 per month and board to work his farm with horses, and tend to them, he will not be unwilling to pay $100 or $120 a month to a man that can take the place of three or four regular farmhands and all their horses. He will then be saving the additional men's board and horses' keep. So, if the manufacturers and dealers will turn out the right kind of "tractorneers" there will be a good call for their services. They will be doing a true tractor service.

There are many ways to accomplish this through other sources than the manufacturers or dealers. The agricultural schools are doing good work, and could do more by giving their students more field experience. The automobile schools have taken on tractor operating, and are doing some good work. Their pupils also need actual field experience. A great many automobile distributors are lining up their organizations for tractors, and they will, with the help of the manufacturers, make a good many tractor operators out of automobile mechanics.

Should Be Charged for Education

The young man that goes to the agricultural college spends his money to get the education that he is seeking; if he goes to an automobile school he also spends his money, but the farmer with no tractor experience buys a tractor and expects the manufacturer to furnish him this education free of charge.

To make a good "tractorneer" out of the average farmer over 35 years old, who has had no automobile or tractor experience, is surely difficult, and is going to take a good many trips of the service men. To produce results, that farmer should be made to pay for the trips. If Mr. Jones allows his gas to run out, and he calls the dealer, who drives 5 miles to discover it, he should not be permitted, because he is a good friend or customer of the dealer, to join him in a good, hearty laugh, and let it go at that. He should pay well for that trip, and the next time that the engine stops he will look at the gasoline supply the first thing.

Or, if he allows the oil to get low and burn out a rod, or score a cylinder, and the manufacturer should credit the story that will come in from him that he is a good booster, will sell many machines if he is furnished a new cylinder or new connecting-rod bearing, or the dealer writes in that Mr. Jones is the king bee in his community and every sale depends on how Mr. Jones' machine is fixed up, if the manufacturer credits him with his connecting-rod bearing and cylinders, that man is getting his education for nothing.

The manufacturers should charge Jones for everything, send it C. O. D., and, if necessary, to overcome the noise that Mr. Jones makes about having to pay for those things, they should take the money received from him, and more if necessary, and send a man to Jones' neighborhood to sell his neighbors' tractors and counteract this noise. Mr. Jones will then be so busy keeping track of his oil that he will not have occasion to have any more cylinders or connecting-rod bearings sent C. O. D. The first thing we know Jones will be getting good service from his tractor; he will gradually quit knocking, and every one of his neighbors will want one like it. Jones would be paying for his education that was badly neglected in his youth, would be on a par with the boy that goes to the agricultural college.

Satisfying the Owner

Manufacturers' contracts and their representatives have made many dissatisfied tractor owners in the past, and it is time to concentrate effort to eliminate these troubles. Here are a few of them: Over-rating in catalog or in contract; over-selling by verbal statements; free repairs and free service. If we get all of the tractor manufacturers to eliminate these things we will then have tractors that will give satisfaction to 80 per cent of their owners, and that is a good percentage of satisfied owners for any industry. The manufacturer has an obligation in tractor service, and, to my mind, it consists of the following:

First—He should have repairs, all kinds of repairs, at his factory, and should never, no matter how old the machine, or what the part wanted, be out, but should be able to ship promptly any repairs required, for any machine he ever built.

Second—He should have repairs in the territory where he is doing a good business from year to year, so they will not be over 24 hr. by express away from his users.

Third—When he is called upon for a service man that is going to be paid for by the customer, he should send a man that has proved competent to do the work in the least possible time and in workmanlike manner, and thereby save the owner in time and hotel bills. That man should be equipped with the necessary tools to do a field job, or we will take it for granted that, if it is a factory job the owner will have outlined to the manufacturer his work so that the manufacturer will have ordered it in.

Fourth—The manufacturer, for his own record, and to give the tractor owner real service, should maintain field men, whose duty it is to visit each year every tractor of that manufacturer's make that is in the field, and make a report over the owner's signature of its condition, and, by so doing, this service man would counsel with the owner as to the condition of the machine, what should be done to get it into shape for the coming season's work, and, if necessary, write out the order for repairs for the owner so there will be no mistakes, and advise the owner of any mistakes he is apparently making, so they can be eliminated in the future. In other words, check him up and try to make him a better operator. That kind of a man will make money for the manufacturer, the farmer, and for the dealer, and that is truly service—a useful office.

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Catalogs Received

CATALOGS of interest to manufacturers in the automotive industries have been received from the Positive Lock Washer Co., Newark, N. J., and the Kales-Haskel Co., Detroit, Mich. The former contains lists of all sizes of lock washers in both the light and heavy types and the latter contains tables of dimensions of dies for making special washers.

Specifications for 55-Hp. Track-Laying Type Artillery Tractor

Part III

THE center electrode shall be made of metal which will not readily corrode, warp or be burned by the hot gases, and must be packed thoroughly gas-tight inside of the porcelain.

112. The end of the high-tension cable at spark plugs must be provided with suitable terminals properly secured to the cable and spark-plug terminals.

113. The seat for spark-plug gaskets shall be finished to a smooth and plain surface, and the seat shall be at right angles to the center line of spark plug.

114. *Master Clutch.*—The clutch may be either dry multiple disk or dry single disk type. It must be of suitable design for transmitting the maximum torque of the engine, without slipping, and be easily accessible for repairs or replacement of parts.

115. The main frame shall be a skeleton one-piece steel casting, properly annealed. The frame suspension must be so designed as to prevent cramping any part of the mechanism due to distortion of the frame produced by road conditions.

116. The entire transmission mechanism as a unit must be removable from the frame above mentioned. It is preferred that the speed change gears and steering clutches be carried in an upper integral part of this unit and that the sprocket driving mechanism be carried in another lower integral unit.

117. The transmission shall be of the selective sliding gear type giving three forward and one reverse speeds. The gear ratio must be such as to give the vehicle speeds mentioned in paragraph 29. Through drive in the transmission will occur on the second or intermediate speed. The gears shall be of such material and size as to transmit the maximum power of the engine under all conditions with an ample factor of safety to produce long life. Anti-friction bearings are to be used throughout the transmission. An air vent or breather must be provided somewhere on the transmission case. A drain-hole plug of at least 1 in. in diameter shall be provided for draining the entire transmission case and shall be so located that the oil can be readily caught in a pail.

STEERING CLUTCHES

118. These clutches may be either dry multiple-disk or dry single-disk type. They must be of suitable design to transmit the maximum power of the engine, and there must be sufficient action provided to give full engagement and release under all conditions of constant use.

CONTROL

119. The driver shall be located above the transmission, approximately amidships, and as far to the right as practical, so as to give maximum road vision. The driver's seat, which must be long enough for at least two men, shall be spring mounted and provided with cushion and back rest. If required, quick release straps must be provided for holding the drivers in place. Convenient and safe steps must be provided for mounting to the seat.

120. Steering control is to be accomplished by a single horizontal lever pivoted at its center at the top of the steering column. When the right-hand end of the lever is pushed forward it shall release the left-hand steering clutch, and when the left-hand end of the lever is pushed forward it must release the right-hand steering clutch. Proper leverages are to be provided so as to give easy operation to this control lever.

121. Supplementary track brakes of the external contracting type shall be provided, all operating pedals to be located within easy reach of the driver's feet, the left-hand pedal shall control the left-hand track brake and the right-hand pedal shall control the right-hand track brake.

122. The master clutch shall be operated by a hand lever located to the right of the steering column. This lever shall both engage and release the master clutch, and be so arranged as to remain positive in either the off or on position.

123. An emergency brake lever shall be provided to set both brakes simultaneously. This lever shall be supplied with an automatic ratchet, hand released. The lever must be so located as to give maximum power of application at a convenient location for the operator. This brake must be powerful enough to lock the tracks under any conditions.

124. The gear-shifting lever shall be located to the left of the steering column. The gear shift rods in the transmission shall be provided with locking arrangement which will hold the gears positively in either the neutral or working position as determined by the position of the gear-shifting lever. The vibration of military tractors is excessive and these locking means must, therefore, be extremely positive. In addition, a hand released ratchet lock must be provided for holding the gear-shifting lever in each of its four working positions.

125. The spark and throttle levers shall be located immediately ahead of the steering column and work in a horizontal plane, each lever being plainly marked to designate its use. The spark lever shall be the shorter of the two. Both levers shall work in fixed quadrants. Forward motion of these levers shall correspond to increased speed and power. Quadrants shall be marked to show advance and retard.

126. At the center of the rear of the frame shall be located a spring draft gear with its center line from 28 to 29¼ in. above the ground and terminating in standard Ordnance Department pintle or towing hook of the type used with heavy artillery. The frame shall be properly braced to take the proper pull and thrust of a drawbar load of 7000 lb. and also braced to resist side thrust when pulling at an angle. Suitable guards must be provided to prevent the standard artillery connecting poles from damaging any part of the tractor when these poles pull at the maximum angle which the tractor construction will permit. The front of the frame shall be designed to take a closed towing hook of simple design and shall be able to receive a ring of 3 in. inside diameter and of 1½-in. round stock. The height of this hook shall be 29¼ in. above the ground unless a different dimension is approved by the chief of ordnance.

127. A tool box shall be provided and equipped with the Ordnance Department standard lock; this box shall be of suitable capacity to hold all tools and accessories ordinarily required for daily use. The box shall be of steel and attached to the tractor at a convenient place. These tools and accessories must be of excellent quality and in general should be more extensive and of better quality than are ordinarily supplied for commercial use.

128. Each tractor shall be given one coat of red-lead paint and two coats of olive-drab paint mixed and applied in accordance with the formulas and instructions on Ordnance Department drawing 27-26-1. All exposed bright surfaces liable to reflect light shall be painted.

129. *Spare Parts.*—The contractor shall be prepared to furnish as required at a fair price any and all spare parts which the Ordnance Department may order, and these parts must be interchangeable with the standard parts supplied with the tractors.

130. The tractor will be subject to inspection by an inspector under the Chief of Ordnance at the manufacturer's works in order to determine compliance with the requirements of the contract and specifications. See Form 434 for information as to facilities to be afforded inspectors and other details regarding inspections.

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Unit Manufacture

THE automobile industry is the only one in the world in which manufacture by units has been practised on a large scale—meaning the making of one part by one factory and another by some other plant. In no other industry has the parts specialist grown up in anything like the same way. How far can this splitting up process be carried and to what extent will it pay are questions that are now being asked.

The plan to make aviation engines by getting the crankshafts in one place, the cylinders in another, the pistons in another and so on is thought by some to be impracticable. Can Packard make the camshaft gear and Pierce the crankshaft pinion and yet have a proper pair of gears, is the sort of problem that is being faced. There seems no reason why not.

Of course the work is finer than automobile work, but it is not so fine as rifle work. We have become accustomed to buying finished crankshafts, finished piston rings, finished bearings, valves and what not for automobile making, and aviation engine work merely means the use of smaller tolerances to be equally successful. Ball bearings of all sorts of makes are readily and perfectly interchangeable and pistons and cylinders are far simpler things to make accurately. To get the perfection required for aviation engines merely means more care; that is, slower operation.

It is to be hoped that the work of aviation engine part making will be spread widely, that as many as possible of the automobile factories will get their share, because it will be an education to every factory which gets this work. Several automobile manufacturers of large reputation have, in the past two years, had a great deal of trouble with their cars owing solely to lack of care in manufacture.

$25,000 Waste

In one case of a car costing around $1,000 there was at one time $25,000 worth of parts in the stock room not really fit to assemble, although they had been passed by the inspectors. Of course this was a case of the superintendent railroading the inspection, of putting output in front of anything else. The factory was tooled for and capable of excellent workmanship. In this particular case a majority of the parts were used and are now bringing hosts of car owners into the service stations.

If such a factory gets part of the aviation engine contract it will demonstrate to those in charge some useful things. First they will find that it is a desperate nuisance to have a staff of inspectors over whom no control can be exercised, inspectors who give orders instead of taking them. Then they will find that by trying to get poor work by the inspection they are piling up scrap which is a dead loss, for there is no accommodating "public" to take it. Lastly, they will discover that the cost of doing good work is much less than that of doing bad work and that it is not so hard to do good work after all.

An unexpected and crippling loss has saved many an extravagant man from bankruptcy, and the object lesson of being *forced* to do good work can save many a manufacturer from the ultimate loss of his reputation.

What of Steam?

IS the steam automobile going to revive and make another struggle for existence? Is the steam truck going to invade America? Is steam to be tried out again for small tractors of the modern sort?

These are questions that many engineers are asking themselves, and even though no positive answers can be given there is a distinct tendency toward the belief that steam is going to be tried out again on a large scale.

There is every reason why it should be. At the time when steam was practically abandoned for automobile propulsion the chassis was in a half developed state. Axles, springs, frames, in fact all the parts which are common to both steam and gas cars, were far from perfect, while the gas engine was improving much faster than the steam plant. The gas car offered the line of least resistance without a doubt.

In England the steam passenger car never had much vogue since the early Locomobile days, but the steam truck has gained in popularity and is still strong in the market. In America the steam pas-

senger car has had but one representative and the steam truck almost none.

We have now the Stanley and the Doble systems of steam generation and there are many others which might be devised; one could have almost as many different sorts of boilers and firing as there are sorts of carbureters. There is no difficulty in handling kerosene under a steam boiler, nor is a steam car necessarily more troublesome to maintain than a gas car. The total amount of mechanical knowledge required to run a gas car for a long time without trouble is appreciable, and the same amount of somewhat different knowledge would suffice for steam. It is merely a matter of exchanging familiarity with carbureters and ignition for equivalent wisdom concerning burners and fuel and water feeds.

About 1911 there began a general "treatment" of the gas chassis which is best described as tidying up. Redundant parts were eliminated, one piece made to do the work of two or three, one cylinder casting to replace six, and so on. Just the same thing will have to be done to the steam plant, and there is at least equal opportunity. There is no reason why we should not discover how to make a steam chassis as neat looking as a gas one. Actually Stanley and Doble have done much along this line, and the steam truck builders of England have been busy also.

Steam is one way out of the fuel difficulty. There may be better ways, since little is known about liquid fuel engines which burn liquid as liquid. As long as the liquid is readily convertible to gas, as was the gasoline of a few years ago, the gas engine is fundamentally more simple than the steam plant, since it eliminates one heat conversion; but when we come to burn liquid direct there is no internal combustion engine known which is really suitable for vehicular purposes.

Airplane Patents

THE Aeronautical Society of America has announced that it objects strongly to the Manufacturers' Aircraft Association, because it regards that body as a trust likely to act in restraint of aircraft development. The basic trouble seems to be that the society considers the association is likely to stifle individual inventors by making it difficult for a new idea to find adoption and proper recompense.

On the other hand, the manufacturers' agreement was devised to overcome a patent situation which threatened to stifle production of aircraft by tying up the industry in litigation at a time when every ounce of the industry's energy was needed to meet the urgent demand for airplanes and more airplanes.

The association has been successful in its immediate object. Plans for production are going on as they ought to go on and American resources for airplane making will be utilized to the full. While protracted litigation might alter the patent situation, such litigation would cost an enormous sum of money and it would also delay the war program, which is not to be thought of. It is far better to come rapidly to a working agreement, as has been done, and to get on with the task ahead.

With the view of the Aeronautical Society regarding the status of the individual inventor there is some sympathy, but these are not days for crying out before you are hurt; and there is nothing to show that the individual inventor will not actually have a better chance under the association's plan than he would have had in an industry torn asunder by suits and cross suits. The inventor has the best chance in a stable business. Stability is what the aircraft industry needs most of all just now, and the Manufacturers' Association seems more likely to be able to provide that stability than anything else.

That the Aeronautical Society is actuated by nothing but the very highest motives cannot be doubted; it is not questioned by the Manufacturers' Association or by anyone else, but the view the society is taking is open to a good deal of criticism.

The Ford Tractor

IT is now possible to see that Henry Ford, by producing a sound, cheap car very early in the history of automobile manufacture, did an enormous amount of good to the automobile industry all the world over. Whether the Ford tractor is going to have a similar influence upon its field remains to be seen, but there is no reason why it should not do so.

Ford developed the Ford car from first principles, taking only a little from then existing practice. In evolving the tractor he has followed the same scheme, doing his own experimenting on a large scale and building up the tractor to fit conditions as he found them. His machine is in several respects unique and is likely to be copied a good deal.

The tractor industry needs to have its factories organized along automobile lines, needs to be put upon much the same basis of production, and Ford is the acknowledged master of this subject. His entry cannot but do great good to the industry.

Instability

AMERICA has, all of a sudden, to create a huge aircraft industry. From next to nothing something has to be created in a year which will rank with the automobile industry for size. It will be partly a temporary industry also, for there is no expectation that any commercial outlet can be found for airplanes ready to absorb the wartime production schedule immediately upon the conclusion of peace.

This being the case it is only to be expected that there will be sudden changes, great stock market fluctuations and so on. To-day the airplane business is in precisely the same category as the munitions business which sprang up at the start of the war. It will be a strong industry after the war, which the munitions business will not be, but it is only wartime needs which can be figured on just now. It is unthinkable that an industry created in such a manner can become stabilized for some years. It is bound to be unstable in the way that a new mining property is unstable, however rich and permanent a field may afterwards be discovered to exist.

News of the Automotive Industries

U. S. Air Commission on Italian Front

Inspects Fiat Factories at Turin and Views Airplane Maneuvers

PARIS, August 1—Howard Marmon, Herbert Hughes, and the various military members of the American Aviation Commission returned to Paris this week after a detailed visit to the Italian automobile and airplane factories, followed by a few days on one of the most interesting portions of the Italian front. At the Franco-Italian frontier station the commission was met by a group of cars sent by the Fiat company and carried direct to the Fiat factory at Turin. This being the biggest factory in Europe, with 18,000 workpeople and an output of seventy-one trucks a day, in addition to airplanes, airplane motors and other war material, a considerable amout of time was spent there. The Fiat directors threw their entire factory open to the visitors and placed all the latest data and experimental work at the disposal of the technical members of the commission. Howard Marmon voiced the appreciation of the commission at the generous manner in which the Italian authorities and technical experts entered into co-operation with them and the eagerness which was shown to let the American delegates profit by all their knowledge and experience. Other factories in Turin, notably the Spa, were visited, followed by a trip to the airplane and automobile establishments at Milan.

Saw Special Flying

In addition to being given all details of structure and design, the commission had demonstrations of the practical work accomplished by airplanes both singly and in fleets. To demonstrate the conditions of aerial combats, a considerable amount of trick flying was done with all kinds of machines. Several pilots, with three or more passengers aboard, and water-cooled engines, looped the loop continuously for several minutes, thus showing that this class of work is not confined to light scout machines with air-cooled motors. While one of the pilots was flying on his back at 1500 metres his machine caught fire. For 1000 metres the machine nose dived to the ground in a blazing condition, and when it disappeared the commission had the conviction that the pilot could neither pull out of the nose dive nor escape from the burning mass. An hour later, however, the pilot joined the commission at dinner, absolutely unhurt.

At one town the commission was given a demonstration of how the aerial defenses operated. While on a height overlooking the city, warning of an enemy attack was given. Within 3 minutes all the anti-aircraft batteries were manned, and in less than 10 minutes several squadrons of fast Nieuport scout machines were seen in the air, opening out in battle formation to go in search of the supposed enemy. Several members of the commission went to the front by airplane, passing across Italy in its greatest width. While at the front, and on Austrian territory, the commission watched the departure of bomb-dropping airships. On another occasion they were informed that a big fleet of airplanes would cross over the lines at 9.30 p. m. on a raiding expedition over enemy territory. At exactly 9.29 p. m. the bombing machines, flanked by fighting scouts, passed above the camp in which the commission was staying. While at the front all the members of the American commission were presented to the King of Italy, and were invited by him to a dinner served on captured territory in full sight of the Austrian trenches.

Marmon Impressed by Service

Howard Marmon spoke enthusiastically of the fine automobile service maintained by the Italian army in the field, as well as of the various fine motors for airplane service he was able to examine in the field and in the experimental departments of the various factories. Of the 104 mechanics brought over by Mr. Marmon, forty are in England and the remainder in various French factories.

American Aviation Commission at the Fiat plant in Turin, Italy

Car Tax Fixed by Senate

$5 for Each $500 in Value for Cars Costing Up To $3000—Surtax for Higher Prices

PROPOSED MOTOR VEHICLE TAX

Tax	Car Prices
$5.00	Under $500
7.50	$500- 750
10.00	750-1000
15.00	1000-1500
20.00	1500-2000
25.00	2000-2500
30.00	2500-3000
*....	Over 3000

*$10 additional for each $500 in excess of $3,000.

WASHINGTON, Aug. 17—Disposition by the Senate to-day of the motor vehicle tax was one of the features of the day. The war tax on passenger cars has been acted upon by the Senate and is now ready for the House, the Senate deciding to change the recommendations made by the committee on finance in such a way as to increase the tax on the more expensive machines. The section as approved by the Senate now provides that motor vehicles shall be taxed, with the exception as suggested, of those used exclusively for business, as shown above.

The original provision to the effect that for each year's use of a machine the tax shall be reduced 10 per cent up to a gross allowance of 50 per cent was not changed.

It is estimated that a total of $40,000,000 in taxes will be raised on automobiles in the hands of owners, now that it is proposed to make, for instance, a motor car which cost $6,000 pay $90 more than was provided for originally.

What action the House will take on this provision is a question.

An effort by Senator Kirby of Arkansas to have the tax assessed against the manufacturer failed. Senator McCumber of North Dakota, on behalf of the smaller manufacturers, insisted that no enormous profits were made by them last year. An unsuccessful effort was made by Senator Brady of Idaho to have the minimum cost price for taxation fixed at $600.

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Airplanes Bought Abroad

PARIS, Aug. 17—The American aviation service announces that large contracts for airplanes have been placed in allied countries, and that deliveries will begin soon. The American aviation observers who were sent to the British, French, Italian and Russian fronts are prepared to make a detailed report on aerial warfare as carried on by the allied armies.

Ford Makes Airplane Cylinders

Active in War Work—Discovers Cheap Method—Takes No Profit

DETROIT, Aug. 17—The Ford Motor Co., according to a statement made by Henry Ford, is manufacturing 200,000 airplane cylinders of steel for the United States Government to be delivered at the rate of 1000 per day at cost price. The company has just recently developed a method for making the cylinders cheaply and the government is securing the benefit of this new method. Mr. Ford has left the matter of price to be settled by the government after the cylinders are made; the government and Mr. Ford to figure the cost and the government to pay for them without profit to the Ford company. The price, it is said, will be very low. Mr. Ford states that it costs very little more to produce steel now than it did before the war and this plus his new manufacturing method will cause the low price.

With regard to exemptions, Mr. Ford said, "We will not ask exemptions for any of our men. We will save the places for those who are drafted. If we are in business when the war is over, they will be."

E. DeCartier, envoy extraordinary, and minister plenipotentiary of the King of Belgium to this country, has requested Henry Ford to send tractors to Belgium. The request has been granted and a number of tractors will soon be forwarded to portions of Belgium outside of the lines where the people will be educated to use them to replace the farm animals of which there is now a great shortage. Henry Ford & Son is also manufacturing 6000 tractors for England on direct orders from the British Government.

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GARFORD BIPLANE HAS SUNBEAM ENGINE

ELYRIA, OHIO, Aug. 20—The Garford Manufacturing Co. of this city is working on a large tractor biplane, and if the model proves satisfactory to the War Department, may secure an order for this type of machine. The biplane under construction will have a wing spread of 92 ft. and will be equipped with two Sunbeam engines. The engines are already enroute to this city, and a large force of men is at work on the other parts, including the wings, propellers and fusilage.

The new machine is of the battleplane type and was designed by Captain Martin of England, who is said to be on his way here to supervise its construction. A special transmission is used which permits of driving both propellers from one engine if desired. In addition to the crew of three men, the plane will be able to carry 4000 lb. of bombs. It will be equipped with a machine gun mounted directly behind the propellers. The fusilage will be covered with light armor to protect the motor and the crew against bullets from hostile airplanes and against shrapnel from anti-aircraft guns. The engines are of 350 hp. each, so that the total horsepower will be 700.

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Oakland Eight Dropped—Ross Continues Model

NEW YORK, Aug. 21—Supplementing last week's list of automobile makers which have dropped certain models mainly through economy, is the announcement of the Oakland Motor Car Co., Pontiac, Mich., that it has dropped the manufacture of its eight-cylinder car, made up in a seven-passenger model selling at $1,695. The Olds Motor Works has dropped its two-passenger eight selling at $1,467. The Ross Automobile Co., Detroit, on the other hand, instead of discontinuing the eight model, has decided to go on with the manufacture of it.

Several changes have been made in the equipment and construction; Maxwell has increased its wheelbase from 103 to 109 and Regal has adopted Atwater-Kent ignition and starting.

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Dunlop Solid Tire Business Heavy

LONDON, ENGLAND, Aug. 18—The Dunlop Rubber Co., Ltd., has increased its capital stock to £6,000,000 by creation of 3,000,000 new 7 per cent preferred "C" shares of £1, each, 10s. per share to be called up at once and the balance not for a year, at least. The borrowing powers of the board of directors were increased from £300,000 to £3,000,000.

"So rapidly has the business of this company been growing," the company's report says, "particularly in the new mill completed May 1 for manufacture of solid tires for army transport, that last November £1,000,000, 6½ per cent cumulative "B" preference shares were created to double the stock of war materials as a war-time safety guard and to finance manufacture and sale of solid tires. Raw stocks were, however, increased to over £2,250,000, an excess of £720,000 above the amount intended for that purpose. This must be deducted from the fresh capital, and the balance, roughly £500,000, after payment of expenses, will be used to finance greatly increasing normal business.

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Willard Has New Plate Separator

CLEVELAND, Aug. 21—A plate separator made of a porous rubber material which is said to be a very great advance on wooden insulators has been adopted by the Willard Storage Battery Co. The new separator consists of a rubber composition containing an enormous number of threads which act as wicks. The threads are about 1/32 in. long and when wetted by the acid offer little resistance to the passage of current.

The new separator has been tried out on a large scale for as long as 2 years, and it will be obtainable for use in the repair of certain of the Willard batteries as well as being used for new ones. It is said considerably to increase the useful life of the battery.

$2,500,000 Airplane Co. Planned

Glenn Martin Negotiates With Cleveland Capital—May Leave Wright-Martin

CLEVELAND, Aug. 21—Glenn Martin, of the Wright-Martin Aircraft Corp., is in this city conferring with local capitalists on airplane manufacture and it is reported that a $2,500,000 concern will be formed, although this amount is not yet definitely determined. All plans are in a tentative condition. Mr. Martin has not yet severed connections with the Wright-Martin Aircraft Corp. Borton & Borton, the Cleveland investment house, is handling the matter with Mr. Martin and according to reports, Charles E. Thompson, president of the Steel Products Co., and Samuel Mather, director of the United States Steel Corp., are reported as connected with the project.

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SPLITDORF RETIRES FROM STARTER FIELD

NEWARK, N. J., Aug. 22—The Splitdorf Electrical Co. of this city, a pioneer in the manufacture of ignition apparatus for automobile engines and which during the past several years has also produced starting and lighting outfits, including a system adapted for the Ford car, has decided to retire from this field and to confine its efforts in the future to the production of ignition equipment. During the past year the company had two important contracts for lighting and starting equipments, and service for the equipments in the hands of users will be continued, but no new contracts will be taken. The company has recently been going in strongly for the ignition equipment of airplanes, and many of the airplane engines now produced in this country are equipped with its magnetos. The Splitdorf line henceforth will include magnetos, timers, plugs, coils, switches.

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Four Wheel Tractor Now Topp-Stewart

CLINTONVILLE, WIS., Aug. 20—The Four Wheel Tractor Co., organized several months ago at Clintonville, Wis., to manufacture general utility tractors employing a four-wheel drive, has been reorganized as the Topp-Stewart Tractor Co. and the capital stock increased to $500,000. Ground was broken to-day for the first unit of the plant. It is hoped to have the shops ready early in November. The main building will be 66 by 176 ft. The Topp-Stewart tractor is temporarily being manufactured under contract with a large machine-shop at Waukesha, Wis.

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Springfield Body Plans Reorganization

NEW YORK, Aug. 23—The Springfield Body Corp., which recently went into receivership with its president, B. F. Everett, as receiver, will hold a stockholders' meeting to-day to vote on a reorganization of the company.

Record Demand for Low Priced Cars

Prosperous Business for Makers of Models Selling for $1,500 and Under

DETROIT, Aug. 20—Business conditions in the automobile industry are particularly optimistic as regards the low priced car market. Manufacturers of automobiles selling for $1,500 and less find themselves unable to care for all of the business offered and a few of the makers of cars selling between $1,500 and $2,500 are enjoying the most prosperous business in their histories. War conditions seem to have affected the makers of higher priced cars only. The Ford Motor Co. is 80,000 cars behind in orders. The Willys-Overland, Inc., has enjoyed the greatest business prosperity in the past June and July in its history. The Buick Motor Co., Maxwell Motor Co., Chevrolet Motor Co., Dodge Brothers, Reo Motor Car Co., Olds Motor Works, Paige Motor Car Corp. and other companies making cars within the same range of prices are from 30 to 60 days behind in their orders.

War orders placed by the Government and by the allied nations are so arranged that they do not interfere with the general production of passenger cars and trucks or parts. The orders being placed give promise of a continuation and increase of employment to labor throughout the country, and large manufacturers are in consequence optimistic as regards future business. The only cloud on the horizon is that of the cost of gasoline, and this is viewed with hope, as it is thought that the Government will take steps to insure sufficient production and a reasonable price.

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Rainier Up $145 Sept. 1

FLUSHING, N. Y., Aug. 18—The price of the Rainier chassis will advance from $850 to $995 Sept. 1. The "E" type extra body will sell for $115, the "S" panel body for $135, the "A" panel body for $150.

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Studebaker Roadster Price Increase

SOUTH BEND, IND., Aug. 16—The Studebaker Corp. announces an increase in the prices of Studebaker roadsters, effective Sept. 15. The "Four" will be advanced from $985 to $1,025 and the "Six" from $1,250 to $1,335.

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Cole Up $200

INDIANAPOLIS, IND., Aug. 17—The price of the Cole eight will be raised on Sept. 1 from $1,795 to $1,995. This increase was predicted in the Aug. 9 issue of THE AUTOMOBILE AND AUTOMOTIVE INDUSTRIES.

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Muskegon Engine to Produce Truck

MUSKEGON, MICH., Aug. 22—The Muskegon Engine Co. Oct. 1 will start the production of a 2-ton truck at the rate of twenty-five per month. A factory is now being erected. The capital is $150,000. C. E. Johnson of the Piston Ring Co. is president and general manager; L. H. Shuh, secretary and treasurer.

The trucks will be called the Muskegon truck model 20. Continental engine, model C four-cylinder will be used. Other features will include three-point suspension; radiator of armored type; rear axle Torbensen, type C internal gear; chrome vanadium steel springs; artillery type wheel; dual rear solid tires; wheelbase, 144 in.; chassis weight, 4250 lb.; stake type of body, 12 ft. long, 66 in. wide or open express type with or without top. The price is not yet decided.

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1918 Tractor Demonstrations Planned

CHICAGO, Aug. 21—The 1918 tractor demonstrations were considered at a special meeting of the Tractor and Thresher Department of the National Implement and Vehicle Association held last Friday at the Auditorium Hotel. A committee was appointed to make recommendations for next year's demonstrations. The committee consists of the following:

E. J. Gittens, vice-president; J. I. Case, T. M. Co.; W. H. Haggard, Emerson-Brantingham Co.; Finley H. Mount, president Advance Rumely Co.; H. B. Dinneen, John Deer Plow Co., and Dent Parrett, president Parrett Tractor Co.

No action looking toward the better conducting of tractor meets in the future was taken; this matter is all left to the committee the members of which will work together with tractor makers, and evolve a plan. This plan will be outlined at a meeting of the association to be held in the fall, probably in November.

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Buick Plant in St. Louis?

ST. LOUIS, MO., Aug. 20—W. C. Durant, Walter P. Chrysler and other officials of the General Motors Co. and the Buick Motor Car Co. have investigated property and shipping facilities in St. Louis and it is thought that they contemplate the erection of an assembly plant here.

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Nash to Drop Name of Jeffery on Cars

KENOSHA, WIS., Aug. 18—With the announcement in the near future of the 1918 line of the Nash Motors Co., the name Jeffery as applied to automobiles will disappear and the name Nash will take its place. Ever since C. W. Nash took over the Jeffery plant it was apparent that the Jeffery name would gradually be eliminated as soon as Mr. Nash completed his plans. For next season two cars will carry the Nash name, one will be the new Nash car, a new creation which to date has only been shown to the group of thirty Nash distributors that recently met at the factory to go over this new model. The car will be built in a variety of body styles and will sell at well under the $2,000 mark. There will be another Nash car which will be the 67 model Jeffery of this season, which is to be carried on as a seven-passenger model to be known as a Nash model.

Grant To Build Trucks

Acquires Denneen Motor Plant and Business—10,000 Production Started

CLEVELAND, OHIO, Aug. 18—The Grant Motor Car Corp. has acquired the plant and business of the Denneen Motor Co., maker of the Denmo trucks. Denneen stockholders are to receive preferred stock at a price which is said to be more than $100,000. The Grant company has been planning for some time to invade the truck field and decided to purchase the proven product rather than experiment with new models. The Grant factory is to be enlarged and an annual production of 10,000 trucks will soon commence. F. S. Denneen, president of the Denneen company, will be in charge of the engineering and sales of the Grant truck department.

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Jordan to Build Trucks

CLEVELAND, Aug. 22—The Jordan Motor Car Co. will shortly commence to assemble trucks from known units of good quality. Details of the program are to be discussed at a dealers' conference which will be held at the factory Aug. 24 and 25. It is understood that the trucks will be an addition to their passenger car output.

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Lansing Firms Prosperous

LANSING, MICH., Aug. 31—Business is unusually prosperous for the Reo Motor Car Co. and the Olds Motor Works. The Reo truck business is taking on greater proportions than it has ever reached before. The Reo speedwagon is being turned out in quantities of more than 300 per week. The passenger car contract for 1918 is the largest ever made by the sales department. Reo dealers anticipate increased business and twenty-five of the largest are engaged in constructing new garages, sales offices and storage buildings that will cost more than $1,250,000.

The Olds Motor Works is already working to triple its capacity. The Olds company, one of the oldest makers of motor cars, has enjoyed a prosperity which has reaped contracts for thousands of cars more than its highest production record.

Both of these concerns have contracts with local accessory makers.

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Packard Sales Increase 19 Per Cent

DETROIT, Aug. 22—Packard sales of new models for the first month are 19 per cent ahead of the corresponding period last year. The Packard company is just starting a shipment of trucks to the Government. Under a new contract 100 will be shipped before Sept. 1. Two hundred are to be shipped in September and 500 a month after that. The company is asking for 500 exemption blanks and will ask for exemption for all workers engaged in manufacturing for the Government.

Industrial Review of the Week

A Summary of Major Developments in Other Fields

NEW YORK, Aug. 22—Business is settling down to a definite basis after a period of considerable uncertainty. The President's announcement of a $2 base on bituminous coal, the agreement of the makers of finished woolens to name a maximum price for the Government, the improvements of transportation facilities by the railroads have greatly aided the general situation.

Shortage of labor remains the big problem in production. In shipyards, machine shops, and every branch where the skilled mechanic is required there is a lack of men. General unrest also prevails in all classes of labor, due partially to the rumors of fabulous wages in munitions plants.

Government work, naturally, holds the center of the stage as in the past few weeks. In fact, war orders are occupying industry more than ever before, due to the activities of the priority board and the fact that more and more plants which received contract awards are getting down to actual work.

Coal Shipments to Increase

While the hard coal shipments for last month show a decline from the high record of the preceding months, they still continue very heavy. Shipping interests continue to show confidence in their ability to handle the situation on all sizes. Interest at the moment is centered largely on what action will now be taken by the Government, and there is a tendency to mark time, pending further developments in this direction.

In spite of the uncertainties in the bituminous field, occasioned by the persistent rumors of further reductions by the Government, there are signs of renewed activity among the large buyers. This is probably due largely to the growing feeling that transportation facilities will soon be still further restricted by the heavy troop movement and the handling of war supplies.

There is a growing feeling that the big coal companies are going to make good on their promises of increased shipments to relieve the tension in the anthracite field, even though there are labor difficulties to overcome. Very considerable shipments continue to be made in box cars which no doubt will have an important part in meeting the existing emergency.—*Coal Age.*

Diesel Engines in Demand

A canvass of the field shows that there is a brisk demand for Diesel and semi-Diesel power installations, especially in the Southwest, and also in the oil fields, where they are used for pumping. There is also a demand for such power plants for marine work. The Government is taking the entire outputs of several makers for submarine equipment. Many oil engines and small steam turbines are being installed for auxiliary power and for auxiliary work in marine development.

There has been a large increase in the use of gas engines, operated on blast furnace gas, by steel mills. This is a revival of the employment of these installations, as they were comparatively widely adopted several years ago but fell into disuse. There are now four manufacturers producing engines of this type averaging 4000 hp. for this purpose, the demand being largely due to the increased output required of the mills.

Electric central stations are installing all possible capacity in steam units, but are experiencing difficulty in securing delivery, some makers being unable to specify dates under 18 months.—*Power.*

A New Service

¶Herewith THE AUTOMOBILE AND AUTOMOTIVE INDUSTRIES *supplies for the benefit of its readers a general summary of important developments in other fields of business. This is rendered possible by the editorial cooperation of leading industrial publications which are recognized authorities.*

By compressing the general industrial situation into this form we hope to give our readers a clear and comprehensive idea of up-to-the-minute developments which they could otherwise secure only with considerable expenditure of time and effort.

Navy Wants More Destroyers

The big feature of the marine world last week was the announcement of the construction of about 300 torpedo destroyers for the Navy within the next 18 months. The Government has found that the submarine chasers now used are not fitted for deep sea work and that the larger boats about to be built are more suited for this kind of work. There is a great demand from the foreign governments for these boats. Announcement is also made this week that the Shipping Board is about ready to make its bid for an appropriation of $1,000,000,000 from Congress. This amount has been doubled within the last 2 weeks because of the need of a larger fleet of ships.—*Marine Engineer.*

Maximum Price on Woolen Piece Goods

The committee on woolen goods which is co-operating with the Council of National Defense has guaranteed to fix a maximum price to the Government for finished products as soon as the Boston wool market has fixed its maximum prices on raw wool. Another move which is likely to affect this trade materially is the proposal to combine two large sheep raising organizations in the East and West with the aim of stimulating the propagation of sheep, thereby increasing the wool supply.—*Textile World Journal.*

Labor Shortage Acute

The labor shortage in the engineering field continues to be the dominant feature in that industry. The unrest of labor is troublesome at the present time. It is expected, however, that in time labor will be placated and all disputes will be settled. The shortage is due to the tremendous work which is being done on government and domestic contracts. There is a movement in that field to train both men and women for work in that field in the trade schools, the course to be so arranged that they will be ready for work in about 2 weeks.

Non-delivery on contracts continues as another of the big problems in the engineering field still to be solved. It is expected, too, that this state of conditions will continue throughout the length of the war.—*Engineering Magazine.*

Freight Car Shortage Waning

Reports just received by the Railroads' War Board indicate an extraordinary improvement in the freight car supply. The unfilled car requisitions on Aug. 1 were only one-fourth as great as on May 1. The number on May 1 was 148,627, on June 1 it was 106,649, on July 1 it was 77,682, and on the first of August it was reduced to 33,776. This has been accomplished by the use of efficiency methods, as the actual number for freight cars has been no greater, whereas the traffic has markedly increased. The movement of cantonment supplies alone has required the services of 30,000 cars.

Plans for the largest troop movement ever scheduled in the history of this country are now being perfected by the American Railway Assn. at the request of the United States Government. Altogether 687,000 men will have to be transported to the various cantonments that the Government is building to house the new national army. The movement will start Sept. 5; between that date and Sept. 9 the railroads will complete the entrainment of 200,000 men, or approximately 30 per cent of the total number scheduled to be moved to the various training camps. All this transportation will be undertaken without impeding the regular traffic. The magnitude of the task may be realized by consideration of the fact that to move merely one field army of 80,000 men requires 6,229 cars, made up into 366 trains with as many locomotives and train crews.—*Railway Age Gazette.*

The scarcity of lumber for domestic use continues. The government is at present being given priority in all shipments from the lumber companies. The construction of the many military training camps throughout the country has necessitated the abandonment to a large extent of all shipments for domestic use and the transferring of them to the various camps.—*New York Lumber Trade Journal.*

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Orders for Allies Held Up

Although the President has fixed a $2 base for bituminous coal and although coke prices will also likely be fixed, the situation with regard to pig iron is not much clearer than before. The steel market remains in doubt as to prices of steel for the Allies. The American Iron and Steel Institute's committee on steel, which has been the Government's distributing medium for war and ship steel, has practically suspended activities. Orders for 10,000 tons of annealed wire and 20,000 tons of wire rods for Italy have been held up because no appropriation existed which could be drawn upon to buy steel for a foreign Government. The present state of affairs cannot exist much longer. More Government orders are being placed and filled every week. There have been no significant price changes in the past few days.—*Iron Age.*

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Rubber Shipping Assn. Formed

AKRON, Aug. 17—To secure a better understanding with railroads as regards freight matters and to insure proper rates on crude rubber and on finished rubber products, the representatives of rubber companies in Ohio have organized the Northeastern Ohio Rubber Shippers Assn. R. G. Kreitler, traffic manager of the Goodyear Tire & Rubber Co., is chairman of the executive committee of the new traffic body.

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Tungsten Supply Up to Normal Demand

PHILADELPHIA, Aug. 17—The tungsten supply is now equal to the normal demand. The fluctuation in price has been from $7 to $90 per unit, and is now selling for $25. This metal is much used in high grade tools and its present available supply should relieve the situation in the tool market.

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Cutting Lumber for Airplanes

SEATTLE, WASH., Aug. 17—Three camps in Washington and Oregon are engaged in cutting down a total of 300,000 ft. of spruce daily for airplanes.

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Michigan Short of Coal

LANSING, MICH., Aug. 17—Governor Sleeper has telegraphed leading anthracite producers that Michigan is receiving only 6 per cent of its normal supply of hard coal, and that he hopes it will not be necessary to take the matter up with the Government.

English Gasoline Higher

Now Selling at 90 Cents a Gallon—Few Hold Precious Fuel—Coal Gas Used

LONDON, July 26—Wholesale prices of gasoline were raised 4 cents per gallon last week, bringing the quotation up to 90 cents per gallon. This last figure includes taxes and license duties, additional to the retail price which is paid in advance when the license to purchase is obtained.

Only favored ones can now hold licenses to purchase fuel. Even these are expected to face what seems to be a clear case of profiteering on the part of the suppliers. The Motor Trades Assn., which is backing the retailers, has now decided that the dealers must have a profit of 10 cents per gallon in the future.

Fuel substitutes are difficult to obtain, and kerosene has to be entered on one's license the same as gasoline. In normal times there is an ample supply of benzol. The present production of benzol is estimated at 80,000,000 gal. per year, or very little less than the total automobile fuel consumption. Benzol, however, is now taken by the government, so none is available for the public.

The use of coal gas for commercial vehicles is increasing each day. The price of gas varies very considerably throughout the country. In the North, near the large coal fields, it is sometimes as low as 24 cents per 1000 cu. ft., increasing in some places to as much as 72. But even at the latter figure the actual cost of the gas used works out at equivalent to gasoline at 24 cents per gallon, or in the former case of gas at the cheapest rate, to gasoline at 8 cents per gallon.

A big development in the use of coal gas is expected as soon as normal times return. This is particularly so in the omnibus field, especially on the cars making short runs.

It is found that 1 gal. of gasoline can be replaced by 250 cu. ft. of coal gas. At present those cars using coal gas are substituting gas bags for the steel cylinders, which would most certainly be used only for the need of this material for more urgent purposes.

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Suggests Heavier Gasoline

NEW YORK, Aug. 20—In the August issue of the E. H. Clarke Monthly Investment Review, Jefferson B. Shatford, president of the Barnett Oil & Gas Co., suggests that the gasoline shortage problem be solved by extracting an additional percentage of gasoline from crude oil. Such a course necessarily would increase the specific gravity of gasoline, but Mr. Shatford claims that a reduction of say 2 deg. in the Baumé gravity would not be noticeable by consumers. By reducing the gravity from 56 deg.—the measure of standard now supplied—to 54 deg., Mr. Shatford figures, the output could be increased by 900,000 bbl. Moreover, since the heavier gasoline contains a greater number of heat units per gallon or per barrel, he figures that this would result in a gain equivalent to an additional 350,000 bbl., so that the total saving would be equivalent to an additional supply of 1,250,000 bbl. Mr. Shatford says that the lowering of the gravity of gasoline to 54 deg. would not make the end point too high to properly vaporize in any gasoline engine, and the efficiency of the gasoline of this quality, being straight refinery run, would be greater than that of the present product, resulting in a lower fuel expense per mile and solving the fuel shortage problem at least temporarily.

To those who have been struggling with old style motors with inadequate means for vaporizing the fuel, on cold winter mornings, the suggestion will not seem a particularly happy one. It can hardly be said that the scheme is a new one, as distillers have been lowering the gravity of gasoline constantly since the popularization of the automobile created a great demand for the fuel.

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States Investigate Coal Cost

CHICAGO, Aug. 18—Councils of Defense of thirteen Middle West States have been investigating the retail and production costs of coal. Representatives of these councils in session here to-day passed resolutions urging immediate action by the Federal Government to reduce the retail prices. The conference will meet again Aug. 23 to prepare full reports on their investigations.

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Coke Shortage Shuts Blast Furnaces

YOUNGSTOWN, OHIO, Aug. 17—One of the six Carnegie steel blast furnaces here is temporarily banked due to coke shortage.

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G. M. Directors Re-elected

WILMINGTON, Aug. 22—At the annual meeting of stockholders of the General Motors Corp. here to-day, the same directors who have previously acted in that capacity for the General Motors Co. were elected. A meeting will be held in New York to-morrow for organization purposes.

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Gasoline Rise Expected

NEW YORK, Aug. 22—As a result of sharp advances in the price of crude oil in the last few days, an increase in the price of gasoline is looked for shortly. An advance of 2¼ cents in export prices has occurred, this rise also affecting 10-gal. drums.

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Receiver for Eastern Motors

NEW BRITAIN, CONN., Aug. 18—Eastern Motors, Inc., sponsor for the Charter Oak six, has passed into the hands of Judge William Larkum of Waterbury as receiver. Matters came to a head when an attachment was served in the interest of two local concerns whose claims

would average in the neighborhood of $500 each. But one model car has been built and that is in the paint shop in Hartford, where it has been for the past 2 months. Willis Upson of Waterbury and Silas Hall of Meriden are the heaviest interested stockholders. Judge Larkum is Upson's attorney. About $30,000 has been expended under the régime of Allen Sheldon, vice-president and general manager of the company, without visible results.

The company planned originally to do business in Hartford, but could not secure a suitable location and went to New Britain, leasing the old trade school for 1 year. Present indications suggest a resumption of operations.

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Emerson Reorganization Plan Includes $3,491,489 Capital Increase

NEW YORK, Aug. 20—A plan to wipe out all of the old stock has been issued by the Emerson Motors Co. It is proposed to issue $1,000,000 6 per cent cumulative first preferred stock; $113,700 non-cumulative second preferred and $2,377,789 common. The par value per share for each class of stock is $10.

There is at present outstanding $2,718,883 in capital, including $2,377,388 common and $341,095 preferred. The total liabilities are $2,803,192 after adding $42,154 unsecured indebtedness. The valuation of the physical assets approximates $640,197.

Under the reorganization plan, it is proposed to call a meeeting of the stockholders for the purpose of receiving authority to bring about the sale of the assets of the company to the reorganized one.

Each stockholder, according to the reorganization committee, which is composed of L. H. Moos and Williams, Folsom & Strouse as counsel, will be expected to pay 30 cents per share for each share owned of common and preferred, for which he will receive at par first preferred stock in the new company to the extent of 33⅓ per cent of his present stock holdings, either common or preferred.

Non-subscribers to this plan will receive at par the second preferred or common stock of the new company to the extent of 33⅓ per cent of their present holdings of stock of the particular class which they now hold. Deposits of certificates of stock pursuant to this plan may be made up to Oct. 1.

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Receiver Operating Lauth-Juergens

FREMONT, OHIO, Aug. 18—Because of a misunderstanding among the stockholders of the Lauth-Juergens Motor Truck Co., Attorney P. D. Garver has been named receiver of the corporation. Application was made by a number of stockholders, who objected to selling the plant and assets to the Taylor Motor Truck Co., recently chartered and backed by New York capitalists. Receiver Garver was instructed by the court to operate the property.

1918 Maxwell Little Changed

Wheelbase Longer—New Closed Bodies—Demountable Artillery Wheels

DETROIT, Aug. 18—Though the Maxwell Motor Co. has not yet announced its line for the coming year, advance information indicates that mechanically the cars will be little changed. Chief of these changes will be an increase in the wheelbase from 103 in. to 109 in., permitting the use of a longer body.

Several improved closed bodies will be incorporated, among which will be a Sedan, a Berline limousine, and a coupé at $1,095, and a five-passenger touring car with an all-weather top selling for $855. The five-passenger touring car and the roadster will sell for $745. Each of the above prices are f.o.b. Detroit.

The wheels will be of the demountable artillery type, and an extra demountable wheel, carried on a special spare wheel carrier, will be provided.

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FEW CHANGES IN 1918 GLIDE

PEORIA, ILL., Aug. 19—Slight changes have been made in the Glide for 1918. The body lines are more graceful, the appointments more luxurious and the equipment more complete.

The new chassis is 1½ in. lower, with the result that the appearance is improved. This result was obtained by redesigning the front axle and the frame. The clearance of the car is about the same. Tops and windshields have been improved on both touring car and roadster and Jiffy curtains are fitted to both.

The price is $1,395 for both four-passenger roadster with divided front seats and for the five-passenger. With detachable top the latter lists at $1,595.

The engine is a 3⅛ by 5 six-cylinder delivering 40 hp. at 2000 r.p.m. It is in unit with a dry-disk clutch and a three-speed gearset. The clutch has thirteen plates, the driving disks being lined with asbestos. Lubrication is by combination force feed and splash with 2-gallon reservoir in the crankcase base.

Starting and lighting is by a two-unit Westinghouse system and ignition is made by the same company. The fuel system includes a Stewart vacuum system and a Rayfield carbureter.

The wheelbase is 119 in. and tires are 34 by 4.

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De Palma Defeats Oldfield and Chevrolet

NEW YORK, Aug. 18—De Palma in his Packard was victorious in all three events at the Sheepshead Bay speedway, averaging around 110 m.p.h. and defeating Louis Chevrolet and Barney Oldfield in a contest run in three heats of 20, 30 and 50 miles. In the 20 mile he averaged 110.1 m.p.h., in the 30 mile 108.5 m.p.h. and in the 50, 108.9, and in occasional spurts his speed rose as high as 114 m.p.h. Louis Chevrolet in his Frontenac was second in the first two events, finishing just a few feet behind the winner, but in the third contest loss of time due to tire trouble forced him in relinquish the lead to Oldfield. Oldfield was hopelessly outclassed in the 20 and 30-mile races; his Golden Egg was not up to its usual form. In the third race he switched to his Delange and took second because of Chevrolet's tire trouble.

De Palma's time for the three events was:

Distance	Time	Average per Mile	M.P.H.
20 miles	10:53.8	32.69	110.1
30 miles	16:35.6	33.19	108.5
50 miles	27:32.2	33.07	108.9

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Cincinnati Race Called Off

CINCINNATI, Aug. 17—The local speedway race, scheduled for Labor Day, has been called off on account of the inability to get suitable transportation to the track from the Government and also because of the scarcity of drivers, many of whom have entered military service.

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FINANCIAL

NEW YORK, Aug. 17—Though figures are not yet available, United Motors is expected to show gross sales of approximately $33,000,000 for the year ending June 30. Net profits are calculated to be about $8,500,000. On account of the scope of detailed inventories and appraisals final figures of the year's results will not be available for at least 6 weeks.

The net earnings take into account the normal income tax, but make no allowance for excess profits or surplus taxes which are not known as yet and which, therefore, cannot be calculated. The 1917 net of $8,500,000 is equivalent to slightly better than $7 a share on the 1,200,000 share capital.

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CLEVELAND, Aug. 20—Chandler Motor Co. earnings for the 7 months ending July amounted to $1,830,476 compared with $1,030,208 for the corresponding period of 1916. These earnings are equal to $26 per share on the 70,000 shares outstanding.

Cash on hand on July 31 totalled $1,898,000, equal to $27 per share.

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FLINT, MICH., Aug. 20—Final earnings for the Chevrolet Motor Co. for the half year have not yet been compiled, but it is estimated that on a basis of $70 per car profit operating net would be in the neighborhood of $4,500,000. To this may be added $2,700,000 received in dividends from its General Motors stock holdings. This would be better than $22 a share on its 640,000 shares of stock.

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TOLEDO, OHIO, Aug. 17—The Electric Auto Lite Corp. is offering for sale a $5,000,000 bond issue the proceeds of which will be used to take over the Electric Auto Lite Co. of Toledo, Ohio.

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DETROIT, Aug. 20—In the past fiscal year ended July 31, full report for which will be issued soon, the Maxwell Motor Co. turned out 70,000 cars and earned profits of $5,400,000. In 1915 the company turned out 60,366 cars with a net

profit of $5,426,636. Earnings in the recent fiscal year were sufficient to provide the 7 per cent first preferred dividend, 6 per cent second preferred dividend and leave a balance equal to $30 a share on the common stock. As was reported last week only the first preferred dividend was declared.

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DETROIT, Aug. 20—The Hupp Motor Car Co. has reduced its floating debt by several hundred thousand dollars since March 1 of this year. The company shipped 1301 cars in April, carrying 1804 orders over to May. During May 1550 cars were shipped and 1028 orders carried over to June. In June 1083 cars were shipped and 851 orders carried over to July. On July 15 the company had unfilled orders for 761 cars on its books.

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LANSING, MICH., Aug. 22—The Auto Body Co. has doubled its business in the last 12 months and has orders on its books unfilled amounting to $1,750,000. To secure additional working capital to take over this large increase in business the company will sell $250,000 of unissued treasury stock. The stockholders are permitted to buy the stock at par, although the stock is quoted at double par. Par is $10 a share. The company's sales during the first 8 months of 1916 amounted to $864,000. The sales during the same period of 1917 amounted to $1,350,000.

The company has an advantageous lumber contract saving it $100,000 on 7,000,000 ft. of hardwood, and also has 5,000,000 ft. of lumber in stock in addition. It is now employing 1200 men as against 600 last year.

Airplane Stocks Are Weak

Wright-Martin and Curtiss Drop 3 Points—U. S. Rubber Strong

NEW YORK, Aug. 21—Weakness in the airplane stocks featured the activities of the automotive issues last week. Wright-Martin sold down to 9, a new low record, on reports that Glenn L. Martin, recently active in the corporation's affairs, may be made manager of a new airplane company in Cleveland. United Motors was also a weak spot in the automotive field, selling to a new low record at a loss of 3 points. Selling of this stock was due to disappointment over the reported net earnings of the company, which showed only $7 a share, compared with a statement showing $9 some time ago. There has been a strong upward movement in U. S. Rubber stock during the past few weeks. This has been explained as due to the purchase of its stock by the company. About 40,000 shares are said to have been accumulated in the open market in anticipation of what is termed a value plan. No more than $60 a share was paid for any stock, it is understood. Profits of the company are expected to be around $25 a share on the common.

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Silver-Apperson Car for N. Y.

NEW YORK, Aug. 17—In order that he may have a quality car which meets his own requirements, C. T. Silver, for years a figure in the New York trade, has arranged for the production of the Silver-Apperson. This will be manufactured in the Apperson factory, Kokomo, Ind.; will include practically a stock Apperson 8 chassis, but will have a body and certain other specifications which will make it practically a special car for distribution in the New York territory. It will make its appearance at the New York show in January.

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Federal Truck Passes Dividend

DETROIT, Aug. 21—In line with the cautious policy now being observed by many motor companies, the Federal Motor Truck Co. has passed its dividend declaration. Directors of the company thought that the present uncertain period demanded caution and the withholding of certain assets to meet the uncertain future.

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Air-O-Flex Sells Stock

DETROIT, Aug. 21—The Air-O-Flex Automobile Corp., which is organized in the State of Delaware for $2,500,000, has been given permission by the Michigan Securities commission to sell $2,300,000 worth of its stock in this state. Company plans to erect a plant for the manufacture of motor trucks equipped with Air-O-Flex suspension cylinders in place of springs.

The officers of the company are: G. M. Walker, Jr., president; George L. Nadel, secretary; O. C. Creis, vice-president and chief engineer, formerly chief engineer of the Graham Motor Co.; R. A. Weinhardt, treasurer and consulting engineer, formerly assistant chief engineer of the Continental Motors Co.

Automotive Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Net Ch'ge
*Ajax Rubber Co.	66	69	..
*J. I. Case T. M. Co. pfd.	82	85	— ½
Chalmers Motor Co. com.	5	10	..
Chalmers Motor Co. pfd.	..	..	..
*Chandler Motor Car Co.	80¼	81¼	+1¼
Chevrolet Motor Co.	89	93	—1
Curtiss Aeroplane	48½	46½	—3¾
Fisher Body Corp. com.	35¼	39	—2¼
Fisher Body Corp. pfd.	88½	90	..
Fisk Rubber Co. com.	65	70	..
Fisk Rubber Co. 1st pfd.	104	106	..
Fisk Rubber Co. 2nd pfd.	92	95	..
Firestone Tire & Rubber Co. com.	115	118	+ ½
Firestone Tire & Rubber Co. pfd.	102	105	+ ½
*General Motors Co. com.	112¼	113	+ ¾
General Motors Co. pfd.	86½	87	+1
*B. F. Goodrich Co. com.	48¾	49½	— ¼
*B. F. Goodrich Co. pfd.	104⅛	105	— ⅜
Goodyear Tire & Rubber Co. com.	185	190	—8
Goodyear Tire & Rubber Co. pfd.	..	..	..
Grant Motor Car Corp.	3	6	..
Hupp Motor Car Corp. com.	2½	3½	..
Hupp Motor Car Corp. pfd.	79	81	+7
International Motor Co. com.	5	15	—1
International Motor Co. 1st pfd.	30	60	+10
International Motor Co. 2nd pfd.	15	30	+5
*Kelly-Springfield Tire Co. com.	44	48	—1
*Kelly-Springfield Tire Co. 1st pfd.	87	95	..
*Lee Rubber & Tire Corp.	20¼	21	—1½
*Maxwell Motor Co., Inc. com.	30¼	31½	— ¾
*Maxwell Motor Co., Inc. 1st pfd.	66	68	+ ⅛
*Maxwell Motor Co., Inc. 2nd pfd.	20	24	—4
Miller Rubber Co. com.	160	170	—5
Miller Rubber Co. pfd.	102	104	..
Packard Motor Car Co. com.	140	145	+14
Packard Motor Car Co. pfd.	94	99	..
Paige-Detroit Motor Car Co.	24	26	—1
Peerless Truck & Motor Corp.	13	14	—1
Portage Rubber Co. com.	140	150	—5
Portage Rubber Co. pfd.	..	..	..
Regal Motor Car Co. pfd.	..	22	..
Reo Motor Car Co.	25	27	..
*Saxon Motor Car Corp.	16½	17½	—1
Springfield Body Corp. com.	3	6	—2
Springfield Body Corp. pfd.	10	19	..
Standard Motor Construction Co.	10½	11½	— ½
*Stewart-Warner Speed. Corp.	57	59	—3
*Studebaker Corp. com.	52¼	53	—1½
*Studebaker Corp. pfd.	..	96	..
Swinehart Tire & Rubber Co.	..	60	..
United Motors Corp.	20¾	21¾	—3
U. S. Aero Corp.	6⅝	6	+2⅛
*U. S. Rubber Co. com.	63¼	63½	—2¾
*U. S. Rubber Co. pfd.	106	108	—1
*White Motor Co.	45	46	— ½
*Willys-Overland Co. com.	31½	31⅞	— ⅜
*Willys-Overland Co. pfd.	95	95⅞	— ¼
Wright-Martin Air Craft.	10¼	9	—3

*At close August 20, 1917. Listed New York Stock Exchange.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co.	..	22	..
Bower Roller Bearing Co.	25	30	..
Chevrolet Motor Co.	89	91	..
Commerce Motor Car Co.	..	8½	..
Continental Motor Co. com.	6	6⅛	— ¼
Continental Motor Co. pfd.	..	..	..
Edmunds & Jones com.	..	..	..
Ford Motor Co. of Canada	220	230	—2
Hall Lamp Co.	..	20½	..
Hayes Mfg. Co.	..	..	..
Michigan Stamping Co. com.	13	14¾	..
Motor Products	..	..	..
Packard Motor Car Co. com.	140	146	+13
Packard Motor Car Co. pfd.	96½	98½	..
Paige-Detroit Motor Car Co.	23	24½	..
Prudden Wheel Co.	20	21	..
Reo Motor Car Co.	25¾	..	+⅛

INACTIVE STOCKS

Atlas Drop Forge	..	39	..
Kelsey Wheel Co.	82	..	..
Regal Motor Car Co.	..	26½	..

Personals

James G. Heaslet, formerly vice-president in charge of engineering and production of the Studebaker Corp., South Bend, Ind., has gone to Washington to accept a position with the aviation section of the Government under Howard E. Coffin.

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A. A. Gloetzner, sales, service and Detroit factory manager of the Covert Gear Co. and an official of the Hinkley Motors Corp., together with J. D. Harris, of the McCord Mfg. Co., Detroit, A. W. Coplant, of the Detroit Gear & Machine Co., K. W. Hooth of Fuller & Sons Mfg. Co., Kalamazoo, and Carl Clement of the Bock Bearing Co., Toledo, have been called to Washington to assist in the designing of standard military trucks.

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W. H. H. Hutton, purchasing agent for the Timken-Detroit Axle Co., Detroit, has been given a commission as major as a result of his work with the aircraft production board.

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R. M. Harger, advertising manager of the Saxon Motor Car Corp., Detroit, has enlisted in the Marine Corps and will report for service immediately.

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Edson H. Smith, formerly district manager of Dodge Brothers, is now connected with the coast patrol at St. Clair Flats, Mich.

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Frank A. Kapp has been appointed advertising manager of the Mitchell Motors Co., Racine, Wis. He is leaving the Willys-Overland Co., Toledo, as manager of the creative division of the advertising department.

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S. H. Humphrey has been appointed general manager of the Wright-Martin Airplane Co. at New Brunswick, N. J. Mr. Humphrey was formerly manufacturing manager of Chalmers and later of Briscoe and Hupp.

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J. F. Bowman has been appointed director of sales and elected vice-president of the Acason Motor Truck Co., Detroit. Mr. Bowman was formerly sales manager of the Federal Motor Truck Co.

—

Charles Drum will take charge of the Buick body department at Flint, Mich., on Sept. 1. At this time plant Number 4, which will be used for body building, will be completed. It has four stories and is 375 by 26 ft. Mr. Drum was formerly factory manager of the Springfield Body Corp.

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Churchill Chambers, who has been president and general manager of the American Motor Car Co., Chicago, formed last year for the selling of Ford cars, and which brought suit against the Ford Motor Co., for $50,000 for alleged breach of contract, has resigned his position with that concern. He intends taking a vacation and has no plans for the future.

S. S. Toback, who for the past 6 years has been president and general manager of the A. Elliott Ranney Co., New York, now distributor of the Daniels, has resigned. He retains his interest in the company, however, but will take no active part in its administration. His plans for the future have not yet matured to the point where they can be made public. No successor has been appointed.

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F. K. Lane, formerly sales manager of the Chevrolet company, is now special representative for the Monroe Motor Car Co., Pontiac, Mich.

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J. T. Wilson has been promoted to the position of assistant manager of the Nash Motors Co., Kenosha, Wis.

—

C. C. Carlton has been appointed general sales manager of the Prudden Wheel Co., Lansing, Mich. Mr. Carlton was formerly manager of the rim department of the Firestone Tire & Rubber Co.

—

W. P. Taylor, formerly connected with the Lewis Spring & Axle Co. and until recently general manager of the Hell Spring & Axle Co., has rejoined his old chief, Fred H. Lewis at Chelsea, Mich.

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Charles A. Gilbert has been appointed general sales manager of the Carlisle Cord Tire Co., New York. Mr. Gilbert was formerly western district sales manager for the United States Tire Co.

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D. F. Poyer has been appointed manager of the Republic Motor Truck Co. assembly plant recently purchased in Los Angeles, Cal., at a cost of $150,000. The plant will employ 125 men to start and will supply Republic trucks for shipment to South America, Asia, Australia and the Pacific Coast.

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V. H. Day has been elected sales manager of the General Motors Truck Co., Pontiac, Mich., in the truck division, with headquarters at Pontiac.

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C. E. Wertman has been made assistant sales manager of the Whitney Mfg. Co., Hartford, Conn. He was formerly in charge of the cost and efficiency work of the company.

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Andrew Langenbacher has been appointed sales manager of the Duplex Truck Co., Lansing, Mich. Mr. Langenbacher was formerly with the Reo Motor Car Co. in charge of exports.

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R. T. Yeats has been appointed director of sales and exports for the Detroiter Motor Car Co. He has been on the staff of the company since it was founded.

—

Harry C. Pfaff has been appointed sales manager of the Pan-American Motors Corp. He was formerly Chevrolet distributer in Cincinnati, Ohio.

—

Stephen R. Vande Water is severing his connections with the New Departure Mfg. Co., Bristol, Conn., as sales engineer and will be associated with the Iron City Products Co., Pittsburgh, Pa., which is manufacturer of automotive parts, in the same capacity as with the former company.

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W. C. Rowley, recently elected vice-president of the Federal Motor Truck Co., as was announced in a recent issue of THE AUTOMOBILE AND AUTOMOTIVE INDUSTRIES, has taken up his new duties as director of sales and advertising. Mr. Rowley was formerly connected with the Michigan Central Railroad.

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William H. Ellis, Chicago, has taken an important financial interest in the Two Rivers Plating & Mfg. Co., Two Rivers, Wis., and has been elected vice-president and general manager. He formerly was associated with the International Harvester Co. The company makes a variety of metal parts and does a large business in nickel plating.

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ELECTIONS

CLEVELAND, Aug. 17—Michael Gavin, of Montgomery, Clothier & Tyler, New York, has been elected a director of the White Motor Co., to fill the vacancy caused by the resignation of Theodore Roosevelt, Jr.

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NEW YORK, Aug. 21—George C. Taylor, Rodman Wanamaker and J. Kearsley Mitchel were elected to the board of directors of the Curtiss Aeroplane and Motor Corp. yesterday.

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TOLEDO, OHIO, Aug. 22—George W. Shaw has been elected president of the Ohio Electric Car Co., succeeding N. V. Barbour. H. C. Kreps, formerly purchasing agent has been elected assistant secretary and treasurer. E. L. Hoffman has been appointed assistant to the president and assistant general manager.

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CONNERSVILLE, IND., Aug. 21—Frank B. Ansted is now in full charge of all Lexington affairs. He has just been elected president of the Lexington-Howard Co., which manufactures the Lexington car, to succeed his father, the late Edward W. Ansted, who has served as head of the growing institution since the day of its foundation in Connersville.

Mr. Ansted will continue in the position of general manager of the company.

In connection with the changes in office made necessary by the death of Edward W. Ansted, Emery Huston, who for several years has been advertising and assistant sales manager of the institution, was elevated to the second vice-presidency made vacant by the promotion of Frank Ansted. As vice-president, Mr. Huston will also continue his former duties. J. E. Huston is to continue in the capacity of first vice-president and Arthur A. Ansted, a brother of Frank B. Ansted, was elected to the board of directors to succeed his father.

Factory

Four Wheel Drive Auto Co., Clintonville, Wis., is making additions to its plant which will increase the aggregate floorspace to approximately 120,000 sq. ft. The new structures are 100 by 120 ft., 60 by 64 ft., and 100 by 180 ft. The assembling shop will be turned into a machine shop addition, and the present paint shop, finishing and storage building will become the assembly shop. The receiving, stock and shipping departments, now occupying part of the machine-shop, will be housed in a new building, 100 by 120 ft. A new heat-treating room, 60 by 64 ft., is being erected adjacent to the motor testing shop, and the third new structure, 100 by 180 ft., will be used for paint and finishing, and storage of completed trucks.

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Lycoming Rubber Co., Williamsport, Pa., plans the addition of two new buildings to its plant. Construction has been started on a five-story building 110 by 51, and another structure is planned which will be 170 by 75.

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Herschell Spillman Co., North Tonawanda, N. Y., has a new concrete building under construction, 60 by 175, three floors of which will be added to the regular factory, while the first floor will be made into a test room for motors.

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Pullman Motor Car Co.'s service department, purchased recently at the receivers' sale by L. Goldstein & Sons of Philadelphia, has been moved from the Pullman factory at York, Pa., into the vacant storeroom at 133 North George Street. Owing to certain technical errors which the purchasers of this department claim to exist, the recent sale of the assets of the Pullman company has not been confirmed in the United States district court of Pennsylvania at Scranton. As a result confirmation of the sale will be delayed until a hearing can be held before Judge Charles B. Witmer.

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Briggs & Stratton Co., Milwaukee, coils, magnetos, switches and other electrical devices, has given positions to more than 200 women in its new plant at 1047 Louis Avenue, because of the shortage of male help. All of the 200 positions thus filled were formerly occupied exclusively by men. Thirty-five of the women have donned overalls, and the remainder will adopt the garb as soon as the novelty wears off. The women are working on assembling, punch presses and other machinery, and according to the heads of the company, they are doing equally as well as the men.

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Des Lauriers Aircraft Corp. has rented a factory in Newark, N. J., in which it will do assembling work. The building consists of a three-story structure, 200 by 400. The company has also purchased a 6-acre plot, on which will be erected immediately one-story buildings, to be used as a main manufacturing headquarters.

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Menominee Motor Truck Co. has acquired a large shoe manufacturing plant in Menominee, Mich., which will be devoted to truck building.

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Torbensen Axle Co., Cleveland, Ohio, is erecting a two-story building 140 by 110 ft. at a cost of $200,000, to be used exclusively for the production of 3½ and 5-ton axles. In addition to this plant the company is installing a heat treating plant and a power station capable of generating 600 horsepower.

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Standard Steel Castings Co., Cleveland, Ohio, is building a new foundry and machine shop to be devoted exclusively to the manufacture of cast steel wheels. This installation will cost about $350,000, and the melting equipment will include two 3-ton electric furnaces and three 2-ton converters. The output of the new foundry will be 400 wheels per day. The company recently increased its capitalization from $125,000 to $1,000,000.

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Hess-Pontiac Spring & Axle Works, Pontiac, Mich., will build a new steel warehouse to expedite freight handling. Additional plans will be carried out to increase the production capacity of the factory by 1000 tons per month, approximately 25 per cent of the present capacity.

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John Obenberger Forge Co., Milwaukee, which established its new plant at West Allis, less than a year ago, is erecting a 80 by 100 ft. addition, made necessary by the rush of orders for crankshafts, camshafts and other gas engine forgings. The additional facilities will be available about Oct. 1.

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Pelton Steel Co., Milwaukee, operating a large electric steel foundry, at Chicago Road and Elliott Place, has awarded contracts for the erection of a shop addition, 50 by 60 ft., and will install an additional 1½-ton electric furnace unit.

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Landover Truck Co. has taken final steps to locate in Marinette, Mich., and application is being made to secure the license to legally operate and conduct the business. The committee is taking immediate steps to secure the old Iron Works building for immediate operation.

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Victor Wire Wheel Co. has leased the plant formerly occupied by the Gibson Mfg. Co., Kalamazoo, Mich., to be used for manufacturing wire wheels until the company can erect its own factory.

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Appleton Auto Body Co., Appleton, Wis., is preparing plans for a new factory.

Dayton Rubber Mfg. Co. plans to build a new factory in Dayton, Ohio.

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Hiatt Manifold Co., Indianapolis, is placing on the market a manifold bearing its name. This device is to be used on Fords and a guarantee of 30 m.p.g. is given with any five-passenger Ford. The company's address is at P. O. Box No. 971.

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Empire Tire & Rubber Co., Trenton, N. J., contemplates doubling the capacity of its plant, which now occupies 26 acres.

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Wehr Steel Co., Milwaukee, will erect a one-story foundry addition, 80 by 80 ft., to cost about $30,000 with furnace and other equipment.

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Falls Motors Corp., Sheboygan Falls, Wis., has resumed operations after a recess of 1 week for inventory and plant improvements. A 40-in. steel stack, 80 ft. high, has been installed.

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General Motors Co., Detroit, will build a forge shop requiring nine 10 to 15-ton electric travelling cranes and other shop equipment.

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Wellington Auto Manufacturing Top Co., Salt Lake City, Utah, is doing business in temporary quarters due to a fire which completely destroyed its plant recently.

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Oneida Motor Truck Co., Green Bay, Wis., organized several months ago with $300,000 capital to manufacture Oneida motor trucks, has outgrown its present leased quarters and will begin work shortly upon the erection of a complete new factory group costing about $200,000, on a tract of 47 acres. Plans are in process for a main building, 150 by 300 ft., with a separate boiler house and power plant, and blacksmith shop. The treasury stock, now amounting to $125,000, will be disposed of immediately, and nearly all has been taken by the original holders. The company has received orders from the Government to ship two trucks to Texas for tests in the army service and large contracts are contingent upon the performance of the products. A feature of the Oneida truck is the suspension of the power plant to overcome weave, strain and wear under the hardest service. L. P. Fortin, formerly of the Menominee Motor Truck Co., Menominee, Mich., is general manager and chief engineer of the Oneida company.

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Torbensen Axle Co. employees held the first annual outing of their Mutual Benefit Association at Crystal Beach, Ohio, on Aug. 11.

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Monitor Motor Car Co., Columbus, Ohio, which recently increased its authorized capital to $1,000,000, has acquired a large tract located on Third

Avenue near the Northwest Boulevard section, upon which work will be started at once to build a modern automobile plant. The site consists of twenty-five acres, suitably located as to railroad facilities and labor conditions for a larger plant as the business increases.

Confidence in the enterprise was given by the Columbus Chamber of Commerce when it donated money for the purchase of ten acres of the site. The remaining fifteen acres comprising the plot has been leased for a long term of years. The work of building will be pushed, and it is expected to have the plant completed by March of next year. Plans call for two large one-story brick structures, each to have 100,000 sq. ft. of space. One of the structures will be used for assembling purposes and the other for storage. In addition office buildings will be constructed.

The concern has planned to build two models for the coming year. One is to be a six-cylinder car equipped with a Continental engine. The selling price of that model will be $1,195. The other will be four-cylinder with a Golden-Belknap-Schwartz engine, and will sell for $995. Only two chassis will be made, one for the six-cylinder and the other for the four-cylinder car.

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Halifax Cotton Mills, South Boston, Va., contemplates the manufacture of automobile fabrics. The corporation's capitalization is now $500,000, having been increased from $100,000.

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Boone Tire & Rubber Co., Sycamore, Ill., finally has broken ground for the construction of its new $75,000 tire and rubber works at Chippewa Falls, Wis., and intends to be ready to start operations by Dec. 1. Contracts have been awarded for a main building, 66 by 267 ft., and a power plant and office building, to be ready within 90 days. Originally the plant was to have been ready on Aug. 1, but after the site had been staked, a railroad company found it necessary to use some of the tract for right-of-way, which cut directly through the place where the main building had been located, and made important changes in the plans necessary.

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Grant Motor Corp., Cleveland, Ohio, has contracted with the W. S. Ferguson Co. for the erection of a plant addition to cost about $80,000.

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All Season Body Co., Marshall, Mich., has been reorganized and will resume manufacturing activities in the near future. It is stated that plenty of capital has been secured to assure the continued increased operation of the plant.

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Traverse City Motor Co., formerly the Napoleon Motor Co., Napoleon, Ohio, is transferring its property to Traverse City, Mich., and will start production shortly. Sufficient stock has been purchased to provide for 300 completed cars. Material worth $30,000 was transferred to the new company by the Napoleon company and stock and material has been purchased of the Ross Automobile Co., Detroit, to the value of $50,000.

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Whitman Bull Tractor Co., St. Louis, Mo., has bought the machinery and other equipment of the Tors Motor Co., Minneapolis, Minn. This will give the Bull company an output for 35 motors daily.

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Hendee Motorcycle Co., Springfield, Mass., has recently received an order for 3500 Indian motorcycles from the Government.

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Gas Motor Efficiency Co., Janesville, Wis., maker of spark plugs for internal combustion engines, will double its capacity to 1200 plugs in 24 hr. by adding a full night force.

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Cooley Casting Co. and Smalley General Co., Bay City, Mich., have been awarded a $1,000,000 government order for castings and engines. At present about 225 men are employed by the two concerns.

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La Crosse Tractor Co., La Crosse, Wis., has sold a large order of La Crosse Happy Farmer, Model "A" tractors to the French Government.

New Companies

DETROIT, Aug. 22—Lozier Motor Car Co. has been incorporated for $1,000 with John A. Milott, H. M. Butzel and F. M. Butzel, incorporators. H. M. Butzel states that details of the incorporation will be announced within the next few weeks.

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KALAMAZOO, MICH., Aug. 16—The Victor Wire Wheel Co., with a capitalization of $500,000, has been chartered to manufacture wire wheels and parts for automobiles and aircraft. The incorporators are Dwight Seymour, John F. O'Connell and Harry den Bleyker.

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DOVER, DEL., Aug. 16—McCord Silent Sleeve Motors Co. has been formed here with a capital stock of $200,000 to manufacture and sell combustion engines. The incorporators are Edward A. Biggs, Edmund S. Carr and E. W. Kraft.

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MILWAUKEE, WIS., Aug. 17—The American Auto Body Co. has filed articles of incorporation with capital stock of $40,000. The incorporators are L. L. Gridley, David J. Borun and Henry E. Bradley.

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FINDLAY, OHIO, Aug. 16—The Star Tractor Co. has been incorporated with $100,000 capital by J. E. Bicknell, C. L. Casterine, Charles E. Jordan, C. A. Schubert and F. H. Gerdeman.

DOVER, DEL., Aug. 17—The Eagle Tire Co. has been incorporated here to manufacture and deal in motor vehicles, parts, motor boats and bicycles. The capitalization is $10,000.

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BURLINGTON, WIS., Aug. 20—The Burlington Motor Truck Co. has been organized at Burlington, Wis., with a capital stock of $50,000 to engage in the manufacture of truck attachments for Ford chassis. The chief stockholders, G. C. Rasch, George W. Waller and W. G. Rasch, are the principal owners of the Burlington Blanket Co., a large manufacturer of motor and carriage robes and horse blankets. With the passing of the horse, the company is turning its attention to the production of goods to meet the newer conditions, and the truck industry is the result. A factory is now being equipped at Burlington.

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MILWAUKEE, WIS., Aug. 20—The establishment of another large motor truck industry in Milwaukee is forecasted by the announcement of the incorporation of the Titan Truck & Tractor Co., with a capital stock of $100,000 by Joseph C. Millmann, R. S. Boemer and Henry F. Millmann, all of Milwaukee. Although the company is not ready to make full announcement of its plans, it is stated that an experimental shop has been in operation for nearly 6 months and the first models of a 4-ton and a 5-ton truck embodying several new ideas in heavy duty vehicles, will be ready for demonstration. Joseph C. Millmann, founder of the Titan company, retired early this year as secretary and treasurer and sales manager of the Stegeman Motor Car Co., Milwaukee, maker of Stegeman trucks, and since that time has been engaged in the establishment of the new industry.

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NEWARK, N. J., Aug. 16—The Ideal Wheel & Tire Co., Newark, N. J., has been incorporated with a capital of $50,000 to manufacture automobile wheels and tires. Incorporators are: Joseph H. Dwork, Hyman Small, and Max Munzer.

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DEFIANCE, OHIO, Aug. 20—At a meeting of the local business men, plans were made for the formation of a $1,000,000 motor truck company. $500,000 was subscribed at the meeting. The new concern will employ between 400 and 500 men.

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DETROIT, Aug. 15—The Walker Universal Joint Co. has been incorporated with a capitalization of $350,000. Incorporators are George E. Walker, Adelbert H. Lindley and H. A. Hathaway.

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NEW YORK, Aug. 17—The M. H. Keyless Lock Co. has been formed with a capitalization of $10,000 to manufacture keyless locks. The incorporators are: J. Mainzer, I. Heinz, R. Applebome.

JERSEY CITY, N. J., Aug. 16—The Auto Machine Parts Co. has been organized to operate and manufacture automobile parts by Lucien Stone and Philip Corridon.

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SUPERIOR, WIS., Aug. 20—Gustav Engelbrekt, Superior, Wis., is one of the leading spirits in the organization of two new corporations which will engage in machinery and specialties for the automobile industry. The Automatic Machine Co., capital stock, $25,000, will build machine-tools and similar equipment. The Automobile Ice-Box Mfg. Co., capital stock, $50,000, will make self-contained refrigerating units for touring motorists. Fritz Henderson and Erick G. Hoglund are associated with Mr. Engelbrekt in the machine company, and Nels L. Jensen, Theodore Meronk and others appear as incorporators of the ice-box company.

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MILWAUKEE, WIS., Aug. 16—The Detroit Auto Radiator Co. has incorporated its business, established two years ago, for $10,000.

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NEW YORK, Aug. 17—The West Motor Co. has been incorporated with a capital of $25,000 to manufacture commercial vehicles. The incorporators are A. M. Sullivan, S. S. and H. Myers.

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NEW YORK, Aug. 17—The Auto Pedal Pump Sales Corp. has been incorporated with a capital of $100,000 to manufacture motor trucks and accessories. The incorporators are C. L. Beck, K. C. Busch and A. R. Redburn.

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WILLIAMSPORT, PA., Aug. 17—La France Motor Truck Co. has been formed to manufacture trucks. The directors are A. Ward La France, Irving D. Booth and Hubert C. Mandeville.

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WILMINGTON, DEL., Aug. 17—The Bentz-Landis Auto Co. has been formed here with a capitalization of $50,000 to deal in motor vehicles.

CLEVELAND, OHIO, Aug. 16—The Weigel-Warnsmann Wagon & Auto Body Co., $20,000; Henry Weigel, Katherine Weigel, Henry Warnsmann and Sara C. Guest.

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CHICAGO, ILL., Aug. 16—The Axleford Truck Co. has been incorporated with $2,500 capital by Adam Sommers, C. H. Vehstedt and H. B. Vedstedt.

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CHICAGO, Aug. 17—The Hoffman-Morgan Rubber Co. has been formed here with a capitalization of $1,000,000 to manufacture and deal in rubber tires.

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NEW YORK, Aug. 17—The West Motor Co. has been incorporated with a capital of $25,000 to manufacture commercial vehicles. The incorporators are: A. M. Sullivan, S. S. and H. Myers.

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MILWAUKEE, WIS., Aug. 16—The Detroit Auto Radiator Co. has incorporated its business, established 2 years ago, for $10,000.

Calendar

ASSOCIATIONS

Oct. 9-11—Pittsburgh National Assn. of Purchasing Agents, Convention.

CONTESTS

Sept. 1-2 — Detroit, Michigan State Fair. Track Racing and Aviation.
Sept. 3—Uniontown, Pa., Speedway Race.
Sept. 3—Cincinnati, O., Speedway Race, Championship.
Sept. 6—Red Bank, N. J., Track Race.
Sept. 8—Hillclimb, Pike's Peak, for stripped stock chassis.
Sept. 15 — Providence, R. I., Speedway Race.
Sept. 22—Allentown, Pa., Track Race.
Sept. 28—Trenton, N. J., Track Race.
Sept. 29—New York Speedway Race.
Oct. 6 — Danbury, Conn., Track Race.
Oct. 6—Uniontown, Pa., Speedway Race.
Oct. 13—Richmond, Va., Track Race.
Oct. 13 — Chicago Speedway Race.
Oct. 27—New York Speedway Race.
Oct. 24—Columbus, Ohio, Dixie Highway Tour.

SHOWS

Sept. 2-9—Spokane, Wash., Interstate Fair.
Sept. 3-7—Indianapolis, Indiana State Fair, Indianapolis Auto Trade Assn.
Sept. 9-15 — Milwaukee Show, State Park Fair, West Allis.
Sept. 9-15 — Milwaukee, Wis., Fall Show, Wisconsin.
Sept. 17-24 — Grand Rapids, Show, Automobile Business Assn.
State Fair, West Allis, Milwaukee Automobile Dealers.
Sept. 18-21 — Toronto, Annual Tractor Show, Canadian National Exhibition.
Sept. 18-22—Los Angeles, Cal., Second Annual Tractor Demonstration, Traction Engine and Implement Dealers' Assn. of Southern Cal.
Oct. 1-6—Buffalo, N. Y., Closed Car Show. Automobile Dealers' Assn., Elmwood Music Hall.
Oct. 13-28—Dallas, Tex., Dallas Automobile & Accessory Dealers Assn. State Fair.
Nov. 12-18—Denver, Colo., Show, Auditorium, Automobile Trades Assn. of Colo.

1918

Jan. 5-12 — New York Show, Grand Central Palace, National Automobile Chamber of Commerce.
Jan. 19-26—New York, Motor Boat Show, Grand Central Palace, National Assn. of Engine and Boat Manufacturers.
Jan. 19-26—Montreal, Show, National Motor Show of Eastern Canada, Montreal Automobile Trade Assn.

Engineering

American Railway Master Mechanics' Assn.
American Institute of Electrical Engineers.
Master Builders' Assn.
American Society of Heating and Ventilating Engineers.
Association Iron and Steel Electrical Engineers.
Mining and Metallurgical Society of America.
Society of Automotive Engineers.

SEPTEMBER

1—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
8—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
10-14—Assn. Iron & Steel Elec. Engrs. annual convention at Phila.
10—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
10—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
11—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mass. section at Boston.
13—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penn. section at Phila.
14—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ohio section at Cleveland.
15—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.
17—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.
20—Mining & Met. Soc. of Amer. monthly meeting N. Y. section at Engrs. Club.
24—Amer. Inst. Metals at Boston.
24—Amer. Fdry. Assn. annual meeting at Boston.

OCTOBER

6—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
8—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
9—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
10—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mass. section at Boston.
11—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penn. section at Phila.
13—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
15—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.
17-18-19—Amer. Gas Inst. at Washington, D. C.
18—Mining & Met. Soc. Amer. monthly meeting New York section Engrs. Club.

Illuminating Engineering Society.
National Electric Light Assn.
National Gas Engine Assn.
American Society for Testing Materials.
American Institute of Metals.
American Foundrymen's Assn.
Society Naval Architects and Marine Engineers.

20—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.

NOVEMBER

3—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
8—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penna. section at Phila.
9—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ohio section at Cleveland.
10—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
12—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
12—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
13—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mass. section at Boston.
15—Mining & Met. Soc. Amer. monthly meeting New York section at Engrs. Club.
15-16—Soc. Naval Arch. & Marine Engrs. annual meeting.
17—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.
19—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.

DECEMBER

1—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
8—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
10—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
11—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
13—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penn. section at Phila.
14—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ohio section at Cleveland.
15—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.
17—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.
20—Mining & Met. Soc. Amer. monthly meeting New York section at Engrs. Club.